NOV 3 1924

Founded March 1, 1874—Fifty Years of Service

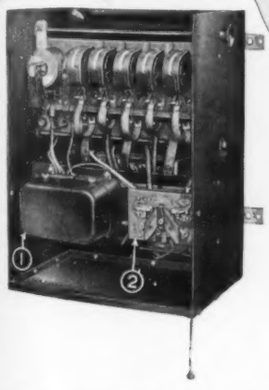
Electrical World

November 1, 1924

Graw-Hill Company, Inc.

Twenty-five Cents Per Copy

Announcing
A New Automatic Compensator



1—Time Limit Acceleration by an accurate and adjustable relay.

2—Over-Load Protection by temperature relay, reset with external pull-cord.

—Under-Voltage Protection.

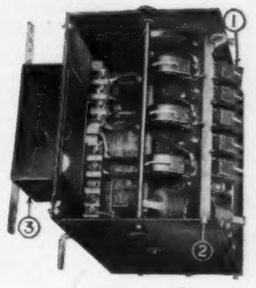
—Adjustable Starting Compensator Taps.

—Unusually strong and attractive steel enclosing case.

Remote Control *for* Squirrel Cage Induction Motors

For frequent starting, as in the operation of machine tools, pumps, etc., we recommend the CR 7051-J1 Magnetic Starting Switch. It provides *dependable response* to any accessory—Push Button, Pressure Governor, Float Switch—and is an enduring reminder of efficient and faithful service.

Ask now for complete information



1—Air Break Contactors—heavy magnetic blow-outs—compactly mounted back to back and mechanically interlocked.

2—Contactor base may be swung out for easy access to rear contactors and terminal board.

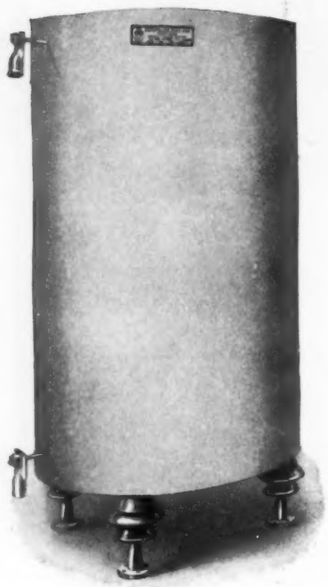
3—Demountable Conduit Box permits entrance of conduit from any direction.

—Top and front covers readily removable.

—Easy to install, connect, inspect, and maintain.

GENERAL ELECTRIC

GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y., SALES OFFICES IN ALL LARGE CITIES



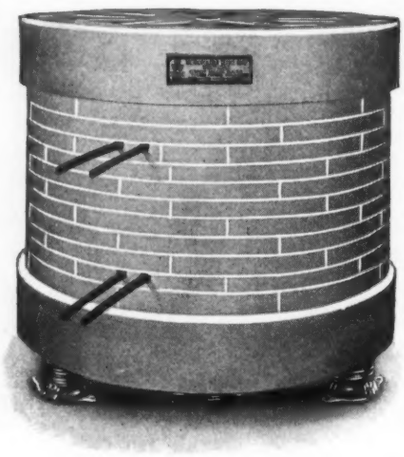
Outdoor Service

User

Boston Edison Co.
Bronx Gas & Electric Co.
Brooklyn Rapid Transit Co.
Calgary Municipal Electric Co.
Canadian Niagara Falls Power Co.
Cataluna Power Co.
Chicago, Lake Shore & South Bend R.R.
Cohoes Light & Power Corp.
Commonwealth Edison Co.
Consolidated Gas & Electric Co.
Dayton Power & Light Co.
East Hampton Gas Co.
Edison Electric Illuminating Co.
Edison Illuminating Co.
El Paso Power & Railroad Co.
French General Electric Co.
Hydro-Electric Power Commission
Havana Elec. Ry., Lt. & Pwr. Co.
Interborough Rapid Transit Co.
Joyce Gridland Railroad Co.
Municipal Gas Co.
New York Edison Company

Testing Reactor

Metropolitan Current Limiting Reactors



Indoor Service, 1000 to 4000 amp.

Give Maximum Short Circuit Protection and Highest All-Year Efficiencies

In daily use upon the greatest generating and distribution systems.

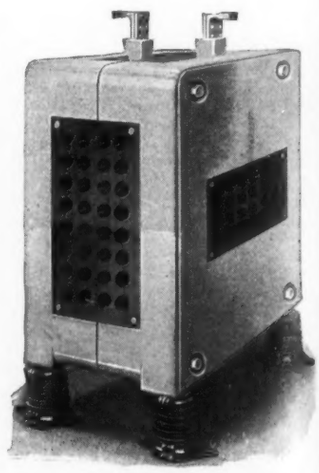
None More Reliable

METROPOLITAN DEVICE CORP.
1250 Atlantic Ave.
Brooklyn, New York

Indoor Service
All Porcelain Clad

User

N. Y., N. H. & H. R.R. Co.
N. Y. & Queens Elec. Light & Power Co.
Potomac Electric Co.
Public Works Department
Public Service Electric Co.
Shawinigan Hydro Elec. Power Co.
Tennessee Power Co.
Toledo R.R. & Light Co.
Toronto Power Co.
Turners Falls Power Co.
United Electric Lighting Co.
United Electric Light & Power Co.
Union Gas & Electric Co., Cincinnati
Union Electric Lt. & Pwr. Co., St. Louis
Utica Gas & Electric Co.
Victoria Falls & Transvaal P. Co.
Warren & Co.
Westchester Lighting Co.
Youngstown Sheet & Tube Co.



Indoor Service
Porcelain Lined

Electrical World

The consolidation of Electrical World, Electrical Engineer and American Electrician

Published by McGraw-Hill Company, Inc.

W. H. ONKEN, JR. Editor — HAROLD V. BOZELL Editor

Volume 84 — New York, Saturday, November 1, 1924 — *Number* 18

The Effect of Cheap Money on the Electrical Industry

WHEN money is plentiful, which means in commercial parlance when it is cheap, industry is not always as careful of its resources as it might be. This is a well-known human trait. "Easy come, easy go" is just as applicable to an industry as to an individual who wastes his substance in riotous living. For each there comes a day of reckoning.

It was hoped that when the German loan was floated the money market would tighten and thus automatically check speculative ventures, but apparently one hundred and ten million dollars was not enough to cause even a ripple in the pool of American wealth. From a public utility viewpoint cheap money is at once an advantage and a detriment, depending upon what use is made of it. If the opportunity is embraced for refinancing—that is, retiring high-rate, short-term bonds in exchange for long-term, low-rate securities—well and good. That is a wise and proper use to make of cheap money. Many dollars of interest may be saved thereby.

However, when systems which ordinarily would not be bought because of their low earning power are eagerly sought, or when high prices are offered for ordinary properties, or when extensions which hold out little hope of paying are made willingly, it is time to call a halt to recklessness. Such transactions are not beneficial to the industry or to the public They should be discouraged by the industry's leaders, the public service commissions and the bankers. The strength of the light and power industry lies in keeping down investment to a minimum. Interest charges should not be courted, but shunned. Only so long as the industry produces a maximum of energy on a minimum of capital expenditure is its position impregnable.

The Value of Water Power

A LARGE portion of the water power in this country yet undeveloped requires storage to make it valuable, and yet a very vague conception exists as to the cost of storage projects or of the many elements that enter into it. Primarily any hydro-electric project must be considered on the financial basis of investment and income, and these in themselves are often difficult of determination. But added to these elements are often found perplexing engineering and legal elements difficult to appraise. For example, while the value of a project depends on the firm power available, in many cases seasonable power can be utilized to advantage and must be credited with some income. In other cases no records are available on which to base accurately the size of storage basin necessary to retain an amount of water that will care for a continued drought or a long period of excessive rainfall.

In some sections of the country where irrigation is practiced water-power development is linked with irrigation to a degree which introduces many difficulties. In one state with a very variable flow of water a power company must put in a storage basin and plant at the headwaters and in addition an irrigation storage basin at a lower level, thus introducing investment costs and diversity in water demands that render developments unprofitable. Conditions such as these make it necessary to treat each prospective development as a specific case and make void many of the general statements put out for public consumption.

Problems in High-Voltage Transmission Discussed

THE behavior of air under high-voltage stresses and other factors in high-voltage transmission were discussed at the Pacific Coast convention of the American Institute of Electrical Engineers, in Pasadena. The engineers of the pioneer 220-kv. lines presented new data, and the specialists in corona added other papers in an endeavor to determine quantitative laws for insuring greater efficiency and reliability. The thanks of the electrical industry are due these men for the remarkable success made with existing 220-kv. lines; but, as was to be expected, several minor problems remain to be solved before complete success is obtained. These problems are connected with insulation, corona, control and conductors, and the data and papers presented at the convention indicate their early solution.

A close study of the papers and of the discussion, however, reveals variations in opinion and practices and a somewhat unco-ordinated and hit-or-miss method of attack which need clarification. Experience with transmission at 220 kv. is yet too meager to warrant its unqualified use in regions where service and climatic conditions are more severe than those found in the West. The interconnection of huge systems in the East to transmit large blocks of power and to capitalize on the diversity obtainable from interconnecting metropolitan areas should be approached with a realization that ice, sleet, winds and the necessity for absolute service reliability are requisites that may or may not be met by 220-kv. lines. Although 220-kv. transmission is here to stay, too much is at stake to adopt it in all localities and for severe service conditions without definite knowledge of its limitations as well as its advantages.

The corona papers gave data on large conductors at variance with the quadratic law of Peek in the regions below the critical voltage and near flashover. In the lower region these variations were said to result from unequal distribution of brush discharges and losses occurring on the uneven and rough conductor surface, while in the upper region the field became distorted

because of the shielding effect of corona wheels. These explanations are logical, but a study of the curves shows a regularity not to be expected if they give the full story. More and better data are needed.

The actual nature of lightning and its effects are still undetermined in spite of the presentation of two good papers on these subjects. There is a consensus of opinion on the energy and voltage magnitudes and on the non-oscillatory character of lightning disturbances, but field data over a long period are required to tell the complete story.

The whole convention was of a character to indicate the necessity for a high degree of technical skill in engineers if the art is to be advanced intelligently. Theory and practice are now racing neck and neck in many branches of the industry, and every inducement is offered brilliant minds for developing a greater theoretical knowledge of the art.

The Electric Power Club at the Crossways

THE Electric Power Club at its fall meeting last week, at White Sulphur Springs, West Va., apparently found itself in the uncommon position of having seemingly about completed its work. Organized sixteen years ago as the Association of Electric Motor Manufacturers, it later expanded to embrace also the manufacturers of transformers, control equipment and practically all electric power apparatus. Its concern has been chiefly the development of standards, and great service has been done in the harmonizing of individual designs and practices to further the broader interests of the industry. The time has come, however, when basic principles have been largely decided upon, and apparently a very satisfactory degree of standardization has been achieved. The Electric Power Club is to be congratulated on this fine record, but no one should think that it has come to the end of its opportunity.

These standards, now so well defined, still lack in recognition and in use. There is urgent need for further effort to bring about their general adoption, for it is only in this way that their practical economic value can manifest itself. This presents a problem and a purpose no less worthy than the actual framing of the standards themselves.

Two other lines of endeavor, already started by one or two sections of the club, also offer fine opportunity for constructive work for the whole body. No organization in the entire industry is better able to prepare operating and maintenance rules for power equipment in order that it may render the best service. "The Care and Operation of Power Transformers," already issued by the Transformer Section, sets a worthy example in this direction. The second activity looks to a co-ordinated study of how best to follow up and service power equipment once it has been sold.

There is no lack of work for the Electric Power Club to do—no reason for any of its members to lose interest or to abate enthusiasm. But the problems of power apparatus have a gradual and natural trend toward the great objective of developing its broader utilization by industry—and this is a problem more than merely commercial, more than merely engineering, although it embodies both.

Technical manufacturing standardization—and this is commercial engineering if anything is—must still be carried on. The fact that those problems may now be less numerous than formerly should not dampen the club's ardor but rather give inspiration—for it opens up new fields of endeavor.

An Unexpected Result from Better Kitchen Lighting

THE kitchen-lighting campaigns arose from a realization that the householder was using only one-half or one-third as much light in the ceiling fixture as he should, and when new kitchen-lighting units were installed both householder and central-station company expected that consumption would increase directly with wattage. For example, if a 50-watt lamp had been in use and a 100-watt lamp was installed, it was expected that the kitchen lighting would cost twice as much; or if the 150-watt daylight lamp was installed, three times as much. But there are indications that it is costing more than these direct increases in wattage account for.

Artificial light competes with daylight perhaps more in the kitchen than in the other rooms. Daylight arrives and fails outdoors while work is going on in the kitchen. There is an uncertain period when natural and artificial light must compete and mix in the kitchen, and with a higher intensity of illumination in that room the artificial light is effective longer in the morning and earlier in the evening than with lower intensity as in the case of the original lighting. Adding to this the additional effect of eliminating noticeable color difference when the daylight lamp is used, there results a powerful incentive for operating the new kitchen-lighting unit a longer time twice each day than the old one. Perhaps this should be taken into account in selling kitchen units.

This is one of the many advantages of better lighting to all concerned. Certainly better lighting usually means more lighting.

Emotional Appeal in the Sale of Lighting

ADVERTISING which leaves out emotional appeal is commonplace and less effective that when it touches the emotions. Good lighting is obtained at such a negligible part of the cost of operating a home that appeal based on cost alone has no significance. What light *does* is what counts. In the home it is lighting effect that is desired and its cost is a minor item. Advertising light in this field is feeble, superficial and relatively unappealing if based on cost.

Lighting in the home can make the basement and kitchen more cheerful and lighten the hours of drudgery. It can aid the eyes that are dimming with age or that have been harmed by inadequate and improper lighting of preceding years. It can conserve the eyesight of the children by preventing near-sightedness. Theirs are growing eyes which are susceptible to harm from squinting the eyes to avoid glare or from holding books too close to the eyes in order to see. By dissociating lighting from the fuel bill and placing it in the class of furnishing we have the emotional appeal of charm, restfulness and beautification. Who thinks of inquiring regarding the efficiency of draperies, of questioning the right of a vase to exist as an ornament, of condemning the use of upholstery in making furniture comfortable, of getting along without decorating

the home? Lighting is a very important element in the comfort, restfulness, charm and expression of a home, as it is in the purely utilitarian aspects of household operation. Besides, here are the bases for much argument which has emotional appeal. Why not forget cost unless we compare the cost of lighting with the cost of furnishing and decoration and with the value of cheerfulness and safeguarded vision?

Lighting Campaign Shows Amazing Progress

TWO thoughts stand out as of especial interest at this stage of the Lighting Educational Committee's essay contest, now engaging the attention of school children throughout the United States and Canada. The first is the amazing extent to which electrical men in communities of every size and character have accepted the idea and organized locally to carry out the plan. The second is the response which has come from the school authorities.

It is no small undertaking for a national committee of electrical men to advance an idea and endeavor to obtain local co-operation for its expression. Five years from now electrical leagues will have become established in a very large number of cities and will provide a natural organization for putting in motion such a project, with a mechanism ready at hand for rallying the local electrical interests of each town to its support. But there are only a few more than a hundred leagues now functioning, and it has been necessary to set up special committees in each case to arrange for the operation of the local essay contest. Nevertheless, close to forty-five hundred communities have "tied into" the campaign, including every city but two in the country having a population of a hundred thousand or over. So far two million primers have been given out to children who are studying home lighting that they may compete for the prizes. Meanwhile the committee's national publicity and an astonishing amount of local newspaper advertising are telling the lighting story to everybody.

In the beginning much doubt was expressed as to the possibility of obtaining active co-operation from the schools. The educational authorities are assailed from every side, of course, with ideas that somebody wants to promote through the schools and are on their guard. Most of these ideas are bound up with pure commercial propaganda. Others are frankly of value to an industry, yet honestly educational and in the public interest. The schools have accepted the home-lighting campaign as of the latter class and have given it the heartiest support. A few of the largest cities have been unable to win the approval of their local school boards, but elsewhere the co-operation of the schools has been almost universal. School superintendents and teachers have aided eagerly in enrolling children, in distributing the campaign literature and in other helpful ways. The fact that this has happened in cities like Washington, Cleveland, Detroit, St. Louis, Omaha and New Orleans shows that the idea of obtaining school support was sound.

So the schools have given their indorsement to the value of proper home lighting as an influence for safeguarding eyesight. They have accepted the motives of the electrical men engaged in the campaign as being broad and unselfish. That brings an obligation. The very extent of this public confidence should impress upon every manufacturer, jobber, contractor, dealer and power company the responsibility that rests upon each one to keep the faith and make no effort to derive direct commercial advantage from the contacts which the local contest has brought. This should be made plain in every community.

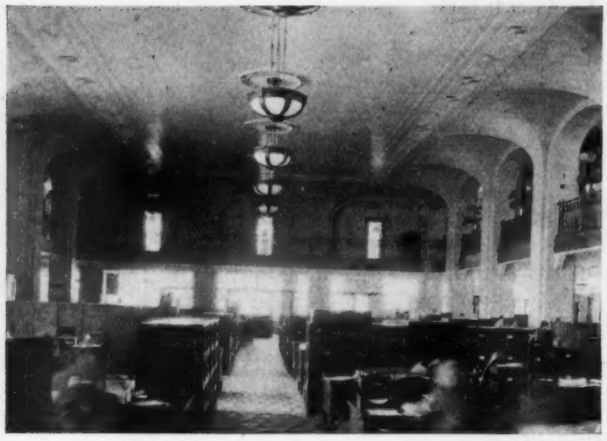
Most of the contests will be over by November 15. Inquiries still come in to the committee, however, and it is not yet too late to start in any town. Local committees have until December 1 to complete their operation and turn in the entries for the national prizes. Let the good work go on.

Interpreting Kelvin's Law

THE degree to which Kelvin's law can be applied in the solution of problems involving the size of secondary mains, underground cables and transformers is remarkable. Like Ohm's law, Kelvin's law is broader than most engineers imagine. One must be in possession of all the facts, however, and know the limitations of the law if accuracy is to be assured and trouble avoided. While the law may hold, it may not take the usual simple form.

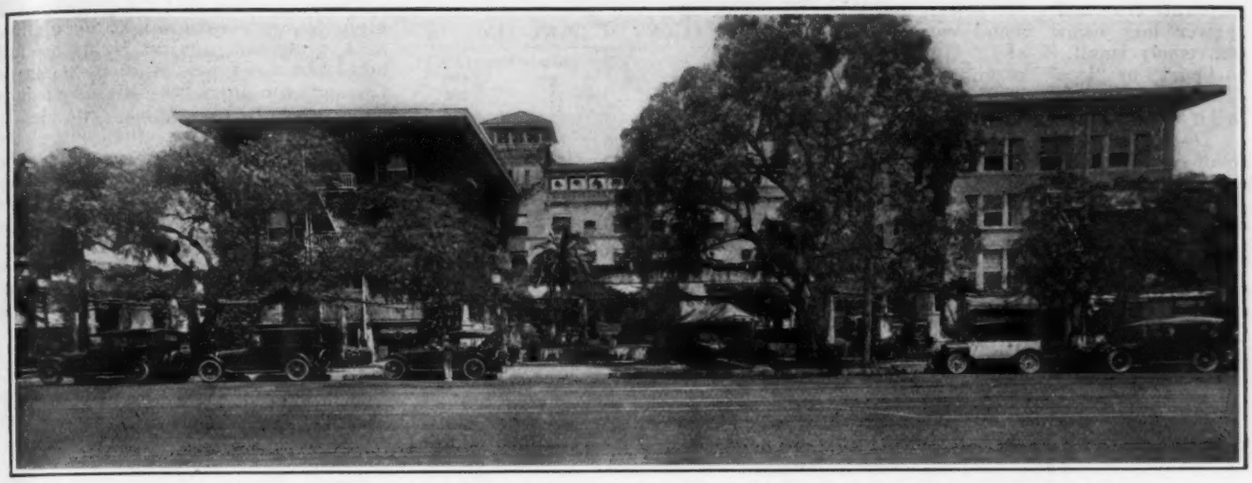
It is the general impression that "Kelvin's law" was originally enunciated by Lord Kelvin, but such does not seem to be the case. In a paper "On the Economy of Metal in Conductors of Electricity" Lord Kelvin asserted that the most economical conductor size for a line for electrical transmission could be found by comparing the interest charges on the wire with the cost of the energy losses. He then proceeded to the formulation of an equation of total annual cost and found a minimum value by the means of taking the first derivative with respect to the cross-sectional area of wire as a variable. In the simple case which he was considering he proved that this minimum occurred when the annual charges on the copper equaled the annual cost of losses. At some later date this result was formulated into a law and received the name of Kelvin's law. It would seem that the formulators of this law missed the important point of Lord Kelvin's discussion; that is, his method of procedure in finding the most economical conductor size. That method—i.e., forming an equation representing total annual cost and then determining a minimum value—is just as applicable to any problem as it was to the simple problem used by Lord Kelvin as an illustration.

The law resulting from his specific solution has not received a wide application and in reality should not bear the name of a law. However, many have used it for solving general problems because it seemed convenient and because they did not recognize the necessity for doing a thorough piece of work. Lord Kelvin, however, as his own writings attest, points out that a thorough study of all factors entering into the problem of design of a line must be taken into account and that from such a study alone an economical solution can be attained. The wire is but one part of a distribution system, and it should be evident that no economical design can be obtained if none of the other elements that enter into line construction are included. The lesson to be drawn from the application of Kelvin's law is that an indiscriminate use of laws and rules whose exact application is not thoroughly understood will not produce sound results and is not engineering.



Modern High-Intensity Illumination Installed by McGraw-Hill Company

THE Hill Building, which houses the McGraw-Hill Company's offices and plant, is a thirteen-story structure towering above its surroundings and well equipped for daylight illumination. It has just been re-equipped for modern artificial illumination with new levels of intensity. The twelfth floor with mezzanine is its principal room and offered the most difficult problem. How well it was solved is shown by the two illustrations below, showing (at left) an earlier installation and (at right) the present installation. Two daylight views at the top of the page, taken from different points, show how well the luminaires suit the room architecturally. An article commencing on page 943 gives a short description of the entire installation.



MARYLAND HOTEL, IN PASADENA, WHERE THIRTEENTH PACIFIC COAST MEETING OF A. I. E. E. WAS HELD

Pacific Coast A. I. E. E. Convention

Results of Researches on Lightning Are Presented, and Corona Developments in High-Voltage Transmission Are Recorded —Notable Papers on Utilization and Communication

THE thirteenth Pacific Coast convention of the American Institute of Electrical Engineers, held at Pasadena, Cal., on October 13 to 17, scored a notable success. The attendance was more than four hundred, and every session was fully utilized in the presentation of excellent papers. The local committee arrangements for handling visitors and giving entertainments of an attractive character were unusually good. A feature of the meeting, as already reported in the news columns of the ELECTRICAL WORLD, was the attendance of more than fifty prominent engineers from the East. Other notable features previously mentioned were the tributes and presentation to Past-president Harris J. Ryan for his distinguished work and the visit to the California Institute of Technology, where a fine group of research papers were presented, the laboratories were visited and a splendid address was given by Dr. Millikan. At the banquet many pioneers of the electrical industry traced the development of the art and outlined problems still to be solved.

Corona Papers a Notable Contribution

ON MONDAY and Tuesday President Osgood presided over technical meetings at which several classical papers were presented on the subject of corona, lightning and high-voltage transmission. Of particular value were the papers on corona and the resulting discussion. These papers represented new work by several independent investigators and many new data were presented. While some things in different papers were rather difficult to reconcile, the discussions brought out the reasons for apparent diversity of results and served to stimulate further research.

The hysteresis character of corona formation was discussed in a paper by Harris J. Ryan and Henry H. Henline. The hysteresis character of 60-cycle corona formation is indicated by the value of the crest voltage and the value of the power loss in corona. Diagrams of the cyclic instantaneous-voltage charge relation in corona formation reveal that in a given case the charge lags behind the corresponding voltage by an approximately constant amount and that the energy dissipated per cycle is proportional to the product of the crest voltage and the difference between the crest of the voltage and the critical voltage. The corresponding equation for the full corona-loss voltage relation is $P = 4fC(E^2 - EE_0)$. Sixty-cycle brushes, coronas and streamers are due to the activity of ions carrying charges largely of the same size as that of the conductors from which they emanate. Local corona is due to an incomplete unstable brush pattern. Full corona is correspondingly due to a complete stable brush pattern. The difference in routing of linear 60-cycle and curvilinear radial frequency discharges is found to be due to the activity of ions carrying like charges in the former and a mixture of unlike charges in the latter.

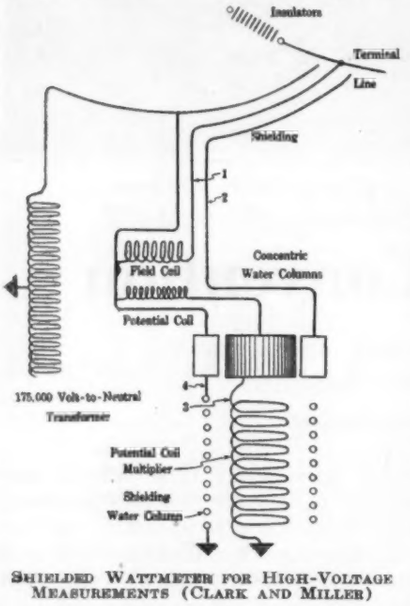
In conclusion, the paper stated that 60-cycle corona in all ordinary circumstances develops the character of a gas dielectric hysteresis. The values of crest voltages are controlling in respect to losses by corona formation, and the critical voltage can have a definite value only when the brush-discharge pattern in corona formation is stable.

A description of a new type of high-voltage wattmeter was given in a paper by Philip C. Clark and Charles E. Miller. The instrument measures losses at low power factor from high-voltage circuits and is assembled around a moving water-column resistance multiplier which permits the direct use of standard low-voltage instruments. A shielding system is used to eliminate capacitance effects in the loading and voltage circuits.

Power measurements with the density low-power-factor, high-voltage wattmeter developed at Stanford University were discussed in a paper by J. S. Carroll, T. F. Peterson and George R. Stray. The apparatus for measurements could be used to measure power values as low as a fraction of a watt at power factors approaching zero and voltages as high as 175 kv. to neutral. A standard make of portable wattmeter was used having maximum ranges of 1.5 watts up to 75 watts and 150 volts and 20 per cent power factor. To this wattmeter was adapted a 3-megohm water-column resistance multiplier. Studies were made of the voltage-corona-power-loss relation for 0.91-in. rope-laid-copper, 0.91-in. lock-wire-copper and 1.006-in. concentric-strand-aluminum transmission-line conductors in rain and fair weather at differing degrees of humidity, temperature and barometric pressures from initial to full corona formation. It was found practicable to

separate true and error power, and the power loss below visual corona was extremely small, if any. Humidity is a "part" or "local" corona loss factor, and losses on dry insulators may be high when they become wet.

Tests to show the effect of conductor configuration on corona losses were described in a paper by J. C. Clark and F. F. Evenson. Several cable samples were used in the tests, and in addition to the effect of humidity, temperature and barometric changes the authors found difficulty in eliminating test



SHIELDED WATTMETER FOR HIGH-VOLTAGE MEASUREMENTS (CLARK AND MILLER)

errors. The effect of spacing and of insulators was also studied. Some data of value was obtained, but further work is contemplated.

Some recent corona-loss tests on the 202-mile, 60-cycle, 220-kv. transmission line of the Pacific Gas & Electric Company were described in a paper by Roy Wilkins. The line contains three distinct configurations with two sizes of conductors. The corona-loss measurements were made from the Pit River power house on the three configurations and from the Vaca substation on one of them, and three methods of measuring corona losses were used at Pit River and four at Vaca. The measured corona losses were found to follow exponential laws in three distinct phases: below visual corona, visual corona and visual corona with losses sufficiently high to produce voltage distortion. At no point did the losses follow a quadratic law. Photographs indicated that corona is the most profuse on the middle conductor and in proximity to ground, also that the conductor next to the parallel circuit on the horizontal spacing has more corona than the outside one.

From the final results it was noticed that the portion of the line having a comparatively low horizontal spacing has a higher loss for low voltages even with the conductors farther apart than the higher vertical spacing. On the higher voltages the closer spacing has the higher loss. This indicates that the distance to ground has considerable effect on the loss and may at times

ELEVATIONS OF 220-KV. LINE

Location	Miles	Elevation, Ft.
Pit	0	2,890
Maximum elevation	15	5,200
Round Mountain	27.5	2,157
Elevation	40	1,000
Cottonwood	60	433
Williams	143	125
Vaca	202	83

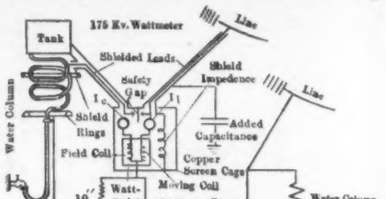
overshadow the distance between conductors. As the voltage is increased a point is finally reached where the slope of the curve changes so that the increase in loss per kilovolt increase in voltage is less than on the lower part of the curve. At this point the current wave begins to be distorted and 180-cycle ground current, which, at the higher voltages, reaches values of one-third of the total charging current.

No actual measurements were taken during storm conditions, although observations were made during a heavy rainstorm at night. The luminous area is made up of corona tufts or brushes about 2 in. long, starting in a bright core and ending in a blue brush at the point where raindrops come near the conductor. Their position would give an average spacing of from 12 in. to 17 in. during heavy rainfall, and from 2 ft. to 3 ft. at times when few raindrops fell. There is no regularity in either their position or direction, and they seem to flit back and forth along the conductor, remaining only a fraction of a second in one place.

It was noted that no raindrops collected on the 220-kv. conductors as they did on the 110-kv. conductor of the same size in the same tower. In the high elevations the same effect was noticed with the snow, it being harder, of course, to see just what happens to the brushes. Roughly, from station meters, the corona loss seems to be approximately double, dropping back to normal again as soon as the storm ceases. Operation of a line below the visual corona point does not always seem to be the final solution, which should be economic rather than technical. The tests show that corona losses reach approximately $100,000 per year in value and bear out the statement that it is desirable to know the loss under operating conditions.

The suggestion that the properties of high-voltage corona might be utilized as a protection against lightning and other similar types of disturbance on transmission lines was discussed in a paper by J. B. Whitehead. The idea in these suggestions is that since the ionization attending corona renders the air conducting, the excess voltage following lightning discharge will be relieved or lowered by leakage between lines or through ground. This explanation is given as the reason for the statement often made that lines operating in high-voltage ranges are freer from lightning disturbances than those operating at lower voltages.

The author concluded that the conductivity resulting from corona on transmission lines is sufficiently high



APPARATUS FOR MEASURING POWER AT HIGH VOLTAGES (CARROLL)

to cause large values of attenuation constant, and the value of corona as a protection against high frequency and steep wave fronts resulting from lightning and other causes is pointed out. It is indicated that only short lengths of corona-forming line, say one or two miles, are necessary for the full measure of such protection. To take advantage of this method, however, the corona-forming voltage should be slightly above the operating values. This may be accomplished by reducing the spacing and size of conductor, or when this is objectionable by equipping the conductors with suitable discharging points. A simple form of spring clip and stud is proposed which gives a discharge equivalent to that from corona and which may be readily mounted on a transmission conductor.

The results of corona-loss tests carried on at Purdue University during the past two years with a single-phase line

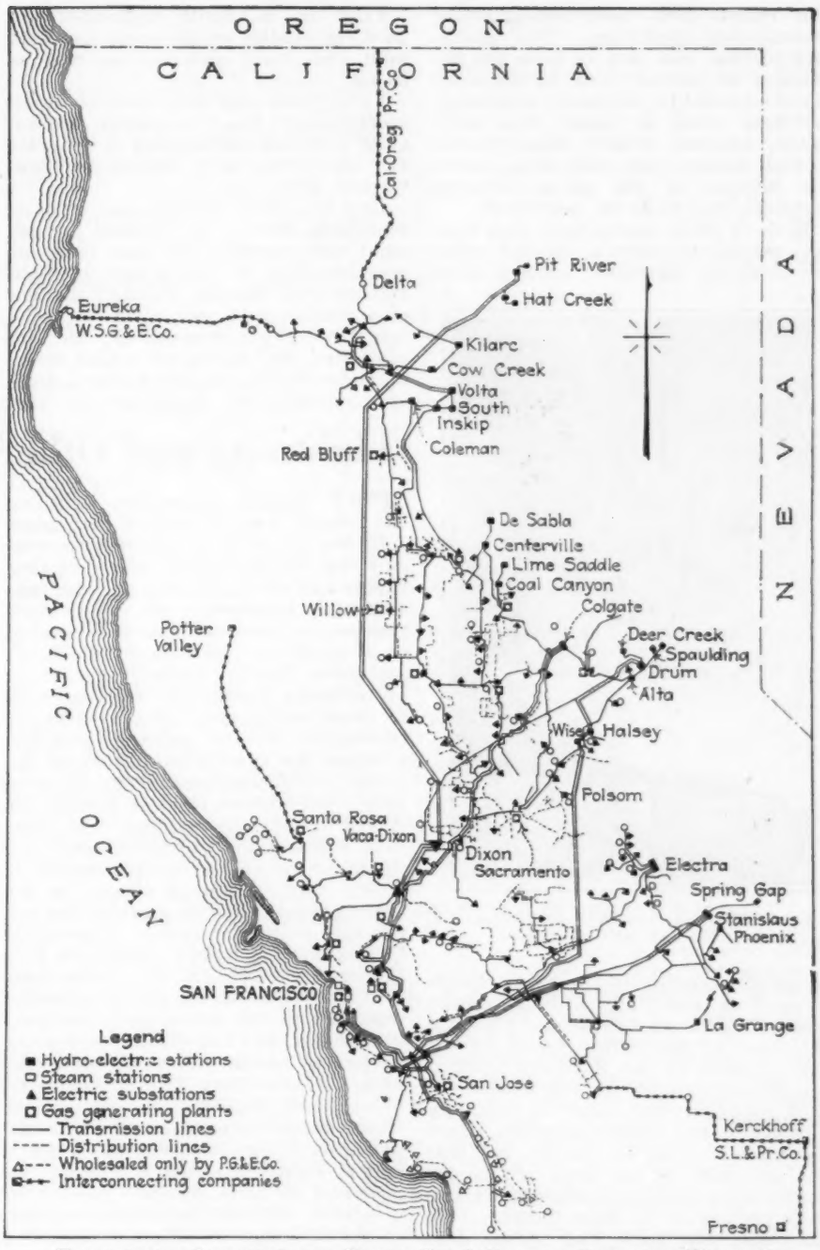
DATA ON STANDARD TOWERS OF PACIFIC GAS & ELECTRIC COMPANY'S 220-KV. TOWER LINES

Item	Single-Circuit Towers Type SA	Single-Circuit Towers Type SC	Double-Circuit Towers Type M	Double-Circuit Towers Type O-98
Height:				
Over-all	55½ ft.	55½ ft.	97 ft.	98 ft.
To lower cross-arm	51½ ft.	51½ ft.	62 ft.	63 ft.
Width:				
At base	20 ft. by 20 ft.	20 ft. by 20 ft.	20 ft.	20 ft.
At cross-arm	4 ft. by 20 ft.	4 ft. by 20 ft.	6 ft.	6 ft.
Conductor separation:				
Between phases	19 ft.	19 ft.	15 ft.	15 ft.
Between circuits	..	..	24 ft.	24 ft.
Conductor:				
Maximum size (copper)	500,000 cir.mil	500,000 cir.mil	500,000 cir.mil	500,000 cir.mil
Loading	8 lb. wind, ½ in. ice	8 lb. wind, ½ in. ice	8 lb. wind, no ice	8 lb. wind, no ice
No. broken	3	3	3	6
Span:				
Normal	500	500	800	800
With angles	...	1000	...	800
Maximum on tangents	750	1500	1000	1800
Maximum contributing weight	1500	2100	1050	1800
Mamimum angle	None	22½ deg.	None	22½ deg.
Type of conductor support	Suspension	D. E. or Susp.	Susp.	D. E. or Susp.
Weight of tower	5,100 lb.	7,270 lb.	8,440 lb.	12,950 lb.
Foundations:				
Concrete, cu.yd.	6.28	11.8	7.8	15.2
Excavation, cu.yd.	18.1	60.4	25.5	84.5

designed for 600 kv. were described by C. Francis Harding. The corona losses were measured upon three standard sizes of cables at various spacings by means of a wattmeter in the high-voltage circuit operating at voltages as high as 620 kv. The line upon which the tests were made was 1,710 ft. in length and consisted of three equal spans of cable supported upon semi-flexible steel tower 65 ft. high.

The cables were supported by standard suspension insulators of fifteen units each, and the three sizes of standard aluminum cable with steel cord were No. 2/0, No. 4/0 and 500,000 circ.mil. A complete analysis of the results of the tests and corresponding losses calculated for the same conditions based on Peek's formula was not possible to complete, but reproduced figures show that the calculated values are consistently higher than test values throughout the high ranges of voltage. This departure seems to be particularly noticeable at the narrow spacings and with smaller sizes of cable. Test results are consistent with those reported at lower voltages in earlier tests made at Purdue, since the theoretical calculation indicates losses less than the test value throughout the lower range of line voltage, while the former calculated values have a steeper slope upward with higher voltages than those found in the test. The net losses throughout the higher range of line voltages during the latter test seem to follow a straight line or a modified quadratic law rather than the parabola of the formula, thereby showing lower values of loss than those calculated.

F. W. Peek, Jr., discussing the above papers, brought out several valuable points. The measurement of corona values had been very difficult and necessitated his taking over a hundred thousand individual readings before he found the quadratic law. He said that the use of low-voltage measurements and high-voltage measurements was now prevalent and that such measurements could be used to check each other closely, but that the sphere gap was subject to certain inaccuracies when used in corona measurements. The early measurements showed that above a certain critical voltage corona loss varied as the square of the voltage, and later experiments tended to show that the law was true, subject to certain restricting conditions fixed by the size and shape of the conductor. At points below the critical corona voltage the corona loss follows a probability law very closely and occurs as brushes which are affected by the size, shape and temperature of the conductor. On extremely high-corona voltages when large conductors are used the corona field becomes distorted and cartwheel corona bands form which give a shielding effect and cause a deviation from the quadratic law. With small conductors the law covers the entire corona range. The tests made by Mr. Wilkins substantiated the quadratic law, provided each individual conductor was considered. In a valley, for example, the high temperature affected the magnitude of the corona losses, although they followed the quadratic law closely because of the uniformity and hard surface of the rope-laid cable, but in the higher altitudes with soft aluminum cable there would result some deviation in the quadratic law as a consequence of the conductor having been marred during its installation, thus affording opportunity for variations due to brush discharges.



TRANSMISSION SYSTEM OF THE PACIFIC GAS & ELECTRIC COMPANY (WILKINS)

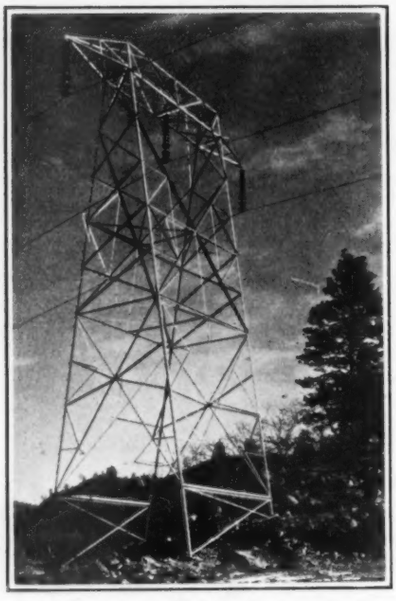
Mr. Peek suggested conductor surface irregularities, field distortion near sparkover voltage values and probable inaccuracies in sphere-gap measurements as reasons for the data in the Harding paper deviating from the quadratic law. He also showed that with two conductors having different critical voltages in series the individual corona losses followed quadratic laws but the composite conductor did not as the addition of two quadratic curves of this character would not give a quadratic as a resultant. The central conductor of three in a plane was stated to have greater corona because the voltage gradient was higher at this location.

Prof. R. W. Sorenson showed slides of electrodes having positive and negative corona charges and suggested that the hysterisis effect obtained by Prof. Ryan might be explained by the difference in mobility and number of ion movements adjacent to conductors when subjected to alternating corona voltage. A. W. Hillebrand suggested that the time element in corona formation might be so small at high frequencies as to permit a self-propagating ionization stream to be set up on the lines.

Dr. J. B. Whitehead indicated the original features of the high-voltage meters developed at Stanford and suggested the use of ordinary meter resistance coils properly shielded as another method which gave prospect of ease of control and high accuracy. In his opinion many of the differences found in published corona data have been caused by measurement errors and the variation in test conditions.

that results from field testing under uncontrolled conditions. The laboratory method was said to have the advantage of control since by it many variables could be eliminated and measurements could be taken more accurately, whereas former measurements of high voltage were difficult to reconcile because of the many different variables that must be considered.

R. J. C. Wood stated that high voltage seemed to have a decided effect on conductor surfaces, causing them



220-KV. TOWER OF THE PACIFIC GAS & ELECTRIC COMPANY (WILKINS)

to blacken rapidly, and that this change in surface materially affected corona losses and corona formation. He cited instances of this effect found on the 220-kv. lines of the Southern California Edison system. It was noticed, he said, that this effect occurred only very slightly in the higher altitudes where the air was clean at 110 kv., but that the operation of the lines at 220 kv. caused the conductor surface to blacken very rapidly in the same location. He suggested the taking of corona data on lines having a synchronous condenser floating at the end so as to eliminate low-power-factor conditions and secure more uniform voltage values at all parts of the line. The modifying effect of existing charges and the necessity for neutralization charging when alternating charges were used were sufficient to explain the loops obtained in corona measurements.

In summing up his discussion of corona, Dr. Whitehead said it was a condition or state in the air whereby the air is ionized to positive and negative charges, this condition being started by the action of a field or a few negative charges adjacent to the conductor. These charges by impact and by recombination make up corona. The open question to be solved is to discover whether the energy loss results from the breaking up and recombination of molecules or from the passage of air molecules between adjacent conductors because the conductors contain charges.

Prof. H. B. Smith suggested the need for studies on dielectric losses in solid and liquid materials as well as in air.

F. G. Baum said that accurate measurements and exact knowledge had enabled electrical engineering to progress and that both were needed in high-voltage work.

R. J. C. Wood stated that data on conditions below the critical corona point were needed but that economic considerations in the design of high-voltage lines usually dictated the use of a conductor of such a size as to be free from any corona losses. He also suggested the making of corona measurements in lines equipped with a floating synchronous condenser so that errors due to low power factor and poor voltage regulation could be eliminated.

L. P. Ferris suggested that some errors might have resulted from computations made by Professor Harding on the assumption that when the actual corona wave form contained a noticeable triple harmonic fundamental frequency-charging current would be increased even though the capacitance were constant.

J. S. Carroll also questioned if wave-form changes were considered by Professor Harding and said that the curves in the paper would turn toward the origin had the corona capacitance instead of the line capacitance been used in the determination.

Lightning and Other Transients on Lines

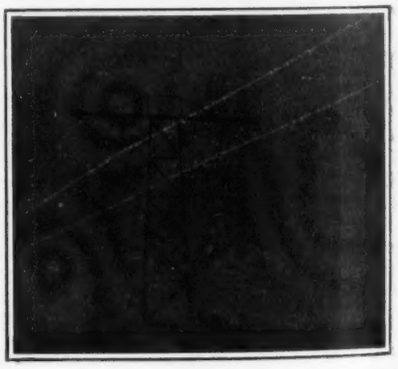
TWO notable papers on lightning created a great deal of discussion. By the use of some new experimental data on the resistance of conducting vapors and the application of some fundamental knowledge of electrostatic phenomena, the conclusion was reached in a paper on lightning by E. E. F. Creighton that the current in a streak of lightning oscillates. Starting with an experimental value of 4,500 volts per centimeter as the average potential gradient for the electrostatic field between the thundercloud and earth, some very high values for the factors involved in lightning resulted. For more than a decade the average current in a lightning stroke has been accepted as 10,000 amp. The calculations in the paper show a value as great as one and one-half million amperes. Some other factors correspondingly large are that the energy stored in the electrostatic field is 700 kw.-hr., the maximum power expended in the discharge is 860,000,000,000 kw. and the frequency for the particular stroke calculated, one mile long, is lower than former estimates, being about 50,000 cycles per second. Check calculations were made on experimental results observed when a bolt of lightning struck a wooden pole protected by a No. 6 wire. The author concludes that all the evidence points to the fact that the effect of lightning discharge is to give an oscillatory action.

Lightning and other transients on transmission lines were treated in an able paper by F. W. Peek, Jr. His conclusions were based largely on experimental data in the laboratory and were to the effect that the voltage of a severe lightning flash is probably of the order of 100,000,000. The current may be 78,000 amp. and the stored energy 13,500 kw.-sec. The discharge, in his opinion, is usually non-oscillatory and often takes place in a few microseconds. The experimental evidence shows that for the most part lightning discharges are impulses of very steep wave front, although some discharges are impulses of slanting wave front and some are oscillatory. The lightning arc-over of insulators is always higher than for 60 cycles and is not greatly affected by moisture. The usual induced voltage is probably below 1,000 kv. and increases almost directly with the height of the line. The maximum possible voltage can be estimated by multiplying the maximum gradient of 100 kv. per foot by the height of the line in feet.

Switching surges and other high-voltage disturbances that occur on transmission lines are damped oscillations and always require a higher voltage to cause insulator flashovers than 60 cycles. A high-frequency oscillation requires an arc, and it is, therefore, a secondary disturbance following a breakdown caused by lightning, dirt or some defect. These oscillations are not serious on grounded neutral systems.

Some very valuable data were presented on the ground wire, and the author concluded that when properly installed under favorable conditions it reduces the induced lightning voltage to 48 per cent of that without a ground wire. For two ground wires the reduction is to 34 per cent, while for three ground wires it is 24 per cent. The reduction is the same for isolated and grounded neutral systems.

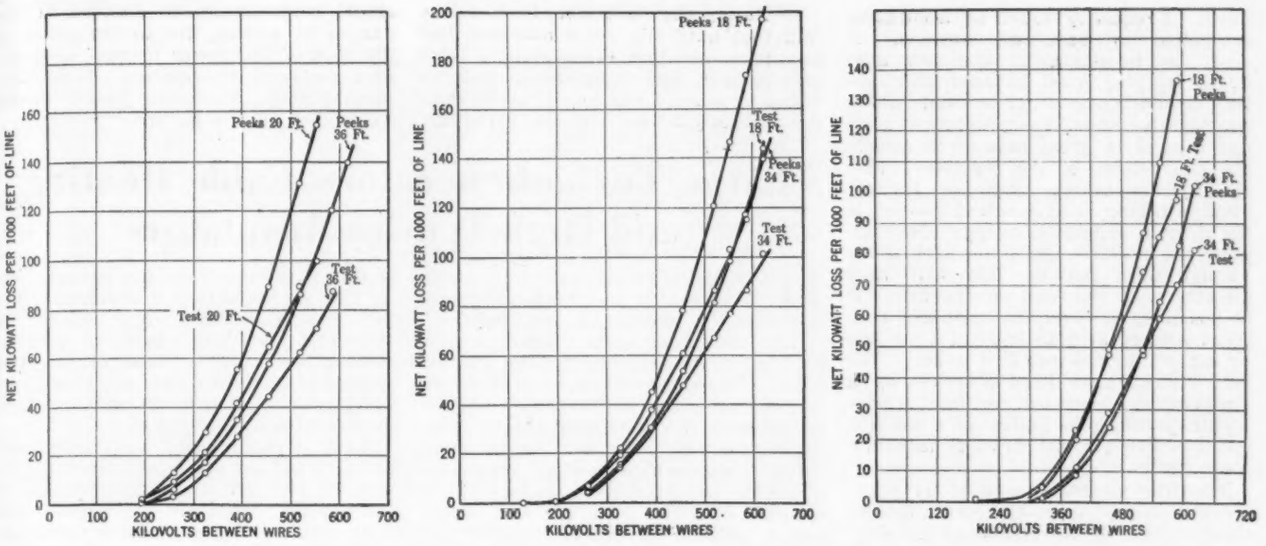
A ground wire is apparently not effective in a dry country unless grounds can be made in conducting soil,



CORONA AT NIGHT AT 600 KV. (HARDING)

while induced lightning voltages are higher in a dry country than in a wet country and the effectiveness of a ground wire decreases as the resistance or inductance of the ground connection increases. The ground wire was also said to be a good protection against direct strokes.

The author held that a 220-kv. line with a ground wire should be almost free from lightning trouble, but that it cannot be said there is any definite volt-



COMPARISON OF NET CORONA LOSSES PER 1,000 FT. FOR VARIOUS SIZES OF WIRES (HARDING)

Calculated values of net corona losses are consistently higher than test values throughout the high ranges of voltage. This departure of actual losses determined by tests from the calculated losses seems to be particularly noticeable at the narrow spacings and with the smaller sizes of cable. The curves on the left are for No. 2/0 cable, those in the center for No. 4/0 cable and at the right 500,000 circ.mil. cable. The cables were supported by standard thirteen-unit insulators.

age where immunity begins, since the unusual may always happen. The danger becomes less and less, however, with increasing operating voltage. The extent to which protection should be used is a combined engineering, operating and economic problem. The technical problem is to determine the strength of apparatus and the voltages to which it is likely to be subjected, and with these factors known the economic problem is to balance the cost of insurance against the value of better service and reduced liability of trouble.

In the resulting discussion F. W. Peek, Jr., suggested that one reason Mr. Creighton obtained such high values of current might be that the data on the resistance path of arcs were obtained with metallic vapors present, while in air much higher resistance values would exist. Dr. J. B. Whitehead said that knowledge of lightning was still only approximate and that while Messrs. Peek and Creighton agreed closely on gradient values the actual voltages given by Mr. Creighton were seven times those given by Mr. Peek. Moreover, Mr. Peek stated that lightning effects are seldom if ever oscillating, while Mr. Creighton said that the lightning discharge has a minimum frequency of 50,000 cycles. The conclusions of Mr. Creighton were based on the assumption of a resistance path in the arc only and on data on metallic-vapor arcs. There is resistance in the cloud itself and in the earth which will materially affect the value of resistance, and in addition the resistance of the ionized air path is much higher than that found in metallic-vapor paths.

Dr. J. Slepian said that no resonance condition would result from lightning unless successive waves of energy entered the circuit, and this would not occur because of the highly damped nature of lightning discharge. He also showed that radiation would be a very decided factor in bringing about the damping effect on the lightning discharge.

In a discussion of the use of ground wires H. Michener said that a new 220-kv. line in southern California would be built without a ground wire because of the difficulty of getting a good ground. A. W. Hillebrand thought that a ground wire would help damped-circuit transients and also said that low ground resistance usually was to be found where lightning was prevalent. He suggested that these conditions were interlinked. H. T. Plumb advocated the use of a capacitance coupling or ground where good grounds are difficult to obtain. He cited the use of buildings or wire fences. F. W. Peek, Jr., was of the opinion that capacity grounds were feasible under certain conditions but were hazardous to human beings.

Transmission and Interconnection

A COMPOSITE paper on the Southern California Edison Company's 220-kv. system was presented by H. Michener, E. R. Stauffacher, C. B. Carlson, W. D. Shaw, J. M. Gaylord and V. D. Elliott. Operating troubles on the system have resulted from flashovers of insulators caused by birds. Guards have largely eliminated this trouble. Aluminum shield rings have been found to give some trouble, fires resulting from the dropping of burning aluminum when flashovers occur. Balanced relay protection against flashovers has given satisfactory results. The unbalanced current is set to trip at 300 amp. and bushing trip current transformers are used. Auxiliary relays act on exciter fields to lower generator voltages in the event of trouble. The time required to handle these disturbances is from two to five seconds.

Economic studies with a view to the proper selection of conductors, towers, spans, tensions, etc., on a 220-kw. line were made by taking short sections of level, rolling and mountain profile for the projected line and plotting tower locations and then applying different conductors to these profiles. A spacing of 22 ft. was fixed in order to have 6-ft. clearance to ground under maximum swing conditions. The study showed that 12,000 lb. was the economical tension for steel-core aluminum cable and that a size of 1,033,500 circ.mil would be required with fifty-four strands of aluminum and seven or nineteen strands of steel. The copper conductor was found to require an outside cable diameter of 1.1 in. and an area of 650,000 circ.mil. No choice has yet been made. The line contemplated is 275 miles long and was connected to transformers of 150,000 kw. capacity. A thorough analysis showed 150,000 kw. to be the maximum economical load for any size of conductor and that several conductors give a flat cost curve between loads of 100,000 kw. and 150,000 kw.

Vibration has caused ground-wire and conductor breakage on some of the long spans. Frequencies of from 13 cycles to 30 cycles and amplitudes up to 1 in. have been recorded. The vibrations are thought to occur from air currents, and no positive remedy has been found. It is proposed to reduce the weight of the dead-end clamps to permit the tower connections to absorb the shocks.

Another interesting part of the symposium showed that it pays to study right-of-way location very carefully in the light of line construction cost. A balance of costs must be made in which all elements can be considered, and in addition there must be a comparison between the costs involved in a straight line and those of a line so located as to entail minimum construction and haulage costs during erection.

Interconnections of power systems in the Southeastern States were discussed in an excellent paper by W. E. Mitchell. He outlined the developments in this part of the country and explained in detail how operations were carried on, how contracts were made and how load divisions were obtained on an economic

basis. Frequency must be accurately controlled by base-load stations. A chief load dispatcher is necessary, adequate relaying must be used, and system developments must be made along co-operative lines. The problem of voltage control is great because it affects the distribution of the reactive power, the system maintaining the highest voltage taking most reactive power. If the system supplying energy also supplies the reactive component, then the voltage over the tie line will vary directly with the load on the line. It is possible, however, to maintain constant voltage at both ends of a tie line by controlling the reactive power. The best results have been obtained by a compromise whereby voltage varies within permissible limits on a tie line and reactive current flows to maintain these limits.

The five papers presented by engineers of the Southern California Edison Company on "Transmission at 220 Kv." were discussed in a group.

Joseph Mini, Jr., said that only a few flashovers had been experienced by the Pacific Gas & Electric Company in the operation of its Pit River 220-kv. transmission line during the year it has been in operation. These flashovers, he said, may be divided into four classes: (1) those due to lightning, (2) those due to dirty insulators with rain, (3) those due to dirty insulators with dew formation (most of these occur during the night or early morning), and (4) those of mysterious origin, which may occur at any time. There are few evidences of flashovers caused by birds, and in his opinion dirt is the chief cause of trouble.

D. I. Cone said that high-voltage transmission has introduced some complicated problems for the communication engineer. Two causes of trouble arise, transmission grounds caused by flashovers and normal ground currents arising from transmission or corona effects. With the aid of such data as had been presented in the papers, the communication engineer is able to calculate more accurately the nature and extent which accidental disturbance on transmission lines will produce on communication circuits.

Speaking of vibration in transmission spans, F. M. Sutton said that vibration had been observed in spans as short as 100 ft. and that the troubles arising from vibration do not necessarily depend upon the length of the span. If vibration is a serious problem, dead-ends should be avoided as far as possible, he said.

In discussing the question of adequate grounds, H. T. Plumb said that not enough caution is taken in ground connections. In most cases grounds are poor, and he suggested getting all the capacity possible in ground connections, even to the extent of using steel buildings and other mediums of large capacity. E. R. Stauffacher said that it is the practice of his company to install multiple-ground wells for transformer neutrals and lightning arresters, to insure adequate capacity.

Referring to the matter of flashovers, H. Michener asserted it to be his belief that birds are the cause of most of the flashovers his company has experienced.

In closing the discussion, H. A. Barre said that naturally some mistakes had been made and that in designing a third transmission line some minor changes would be made. For one thing, he said, the company would not use aluminum shield rings again, on account of the danger of setting fire to the grass at the foot of the tower in case of flash-over followed by ignition of the aluminum ring, when the molten metal would fall to the ground.

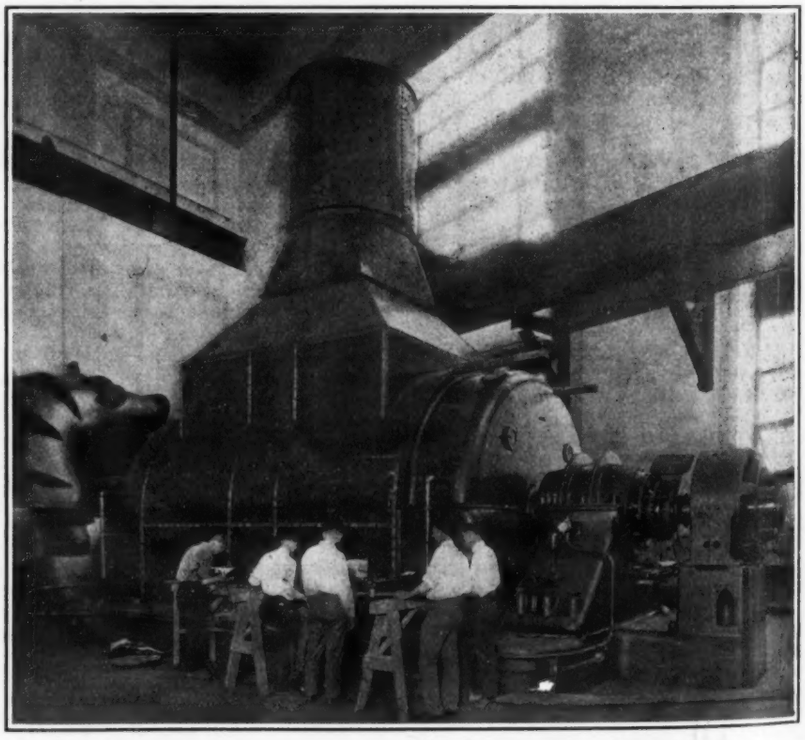
Large Turbo-Generators, Cable Heating and High-Tension Insulators

DEVELOPMENTS in machines, cable heating and insulators were presented on Wednesday morning.

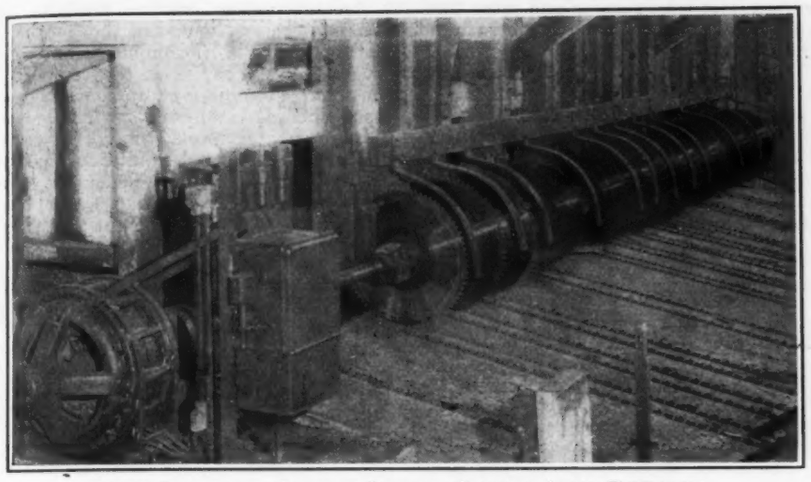
The design of large steam turbine generators and their operating characteristics were treated in a paper by W. J. Foster, E. H. Freiburghouse and M. A. Savage. In particular, the six-pole, 62,500-kva., 80 per cent power-factor, 1,200-r.p.m. self-ventilated units installed in Brooklyn were discussed. The weights of these units are as follows: Rotor, 205,000 lb.; stator, 205,000 lb.; shields, etc., 25,000 lb., or a total of 435,000 lb., not including base, bearings or pedestals. Each has 41,250 lb. of copper and 42.1 miles of wire. The rotor consists of three forgings, the middle being hollow. The stator frame consists of six annular cast I-sections held at the outer periphery by heavy boiler plate riveted to the section flanges. Twenty-eight rectangular steel bars are bolted to the inner periphery of the I-sections.

There are 126 coils in the winding, each having three turns of 85.8 per cent pitch. Each turn consists of sixteen asbestos-insulated strands having a section of 0.21 in. x 0.085 in. Connected with six circuits per phase, a current density of 1,521 amp. per square inch is obtained. The total thickness of insulation from copper to slot wall is 0.28 in. Nine leads are brought out as the six circuits are separated into two groups of three circuits each. Of the three leads per phase one goes to neutral and one to each of the two groups of circuits. This gives balanced relay protection and differential protection facilities.

Long investigations on temperature show that on machines from 12,000 volts to 14,000 volts the temperature of the copper is about 15 deg. higher than that obtained by a 20-in. detector installed between the top and the bottom of the coils in the slot when the coils are from 55 deg. to 60 deg. above ingoing air. Temperatures obtained by a resistance detector or by a thermocouple on bare copper are about the same, and temperatures at the half way location in the slot are about 2 deg. lower than at the ends. The actual test temperature rises on the 62,500-kva. generators gave 48 deg. C. for the stator slot by a 20-in. detector and 72 deg. C. for rotor winding when operated at full-load current and 13,200 volts. Efficiency tests showed about 97.6 per cent at full-load unity power factor and 97.1 per cent at full-load 80 per cent power factor. At 30,000 kw. these reduced to about 96.2 per cent and 95.8 per cent respectively. The air required is about 112,500 cu.ft. per



THE 62,500-KVA. GENERATOR OF THE BROOKLYN EDISON COMPANY EQUIPPED WITH A TALL STACK FOR THE PURPOSE OF DETERMINING THE QUANTITY OF AIR FLOWING THROUGH THE MACHINE (FOSTER)



SLAB SLASHER OF CIRCULAR SAWS IN COMMON ARBOR DRIVEN BY DIRECT-CONNECTED INDUCTION MOTOR (WRIGHT)

minute for the multiple-path radial system.

No great gain in size of units is expected unless it is possible to exceed the present peripheral speed of 25,000 ft. per minute and the limitations imposed by "stiff-shaft" designs.

The temperature rise in cables having a cross-section of from 605,000 circ.mil to 1,033,500 circ.mil was discussed in a paper by R. J. C. Wood. Temperature-rise tests were made in order to determine the performance of the 220-kv. transmission line of the Southern California Edison Company between Big Creek and Los Angeles. This line when normally loaded will carry about 450 amp., and when a fourth transmission line is put into service sections may be required to carry 900 amp. continuously.

A series of tests were made, both in still air and in wind, of three sizes of aluminum steel-cored cable. These sizes were 666,000 circ.mil, 605,000 circ.mil and 1,033,500 circ.mil. In these tests the rate of heat dissipation was found to be 66 per cent more at 100 deg. C. rise than at 10 deg. C. rise and to increase 17 per cent even between 30 deg. C. and 60 deg. C. temperature rise.

Blackened aluminum cable dissipated 40 per cent more energy than bright cable with equal temperature rise. It was found that the effect of wind in cooling the conductor is of great importance, even an almost imperceptible breeze of 0.2 mile per hour having a marked cooling effect. Emperical equations have been obtained for the watts lost per square inch of surface, both for clean and black wire, and for the additional convection losses due to wind.

Insulator flashovers and their prevention were discussed in a paper by A. O. Austin. The author asserted that tests did not justify the general belief that the insulator problem on the high-voltage line is to improve the gradient on the sections. He said that where large factors of safety are necessary greater economy can be effected by increasing the flashover of the units in proportion to the stress which they have to carry; in other words, the unit factor of safety is the real criterion rather than string gradient. An insulator is always a compromise as it may fail under voltage by a path through the insulator, or puncture by flashing over the surface, by a breakdown of the air path around or by a combination of these effects. All factors must be improved, and the improvement of string gradient sets up poor conditions in the air path, causing a greater tendency to arc to ground, particularly at high frequencies. The best method to prevent spill-overs at low voltage is to prevent a streamer or discharge from making use of the negative coefficient of the air to obtain a low-resistance path to ground. Two methods available are the use of insulated control and the conductor cage. The author also advocated the use of a few large units in a string to break up drip water or to eliminate bird trouble, and he proposed improvements in design to obtain greater unit factors of safety.

A new type of suspension insulator was discussed in a paper by Prof. H. B. Smith. This insulator uses an impregnated wooden stick separating two metal shields and is suggested for use as a single unit on high-voltage lines. A full description will be found in the ELECTRICAL WORLD for June 14, 1924, page 1229.

In discussing the paper by Mr. Austin, F. W. Peek, Jr., stated that there are, roughly, two kinds of high frequency and that the type which requires enormous amounts of energy to maintain, either because no damping exists or because the wave trains are continuous, seemed to have been used by Mr. Austin in developing insulator control. As a matter of experience this type of high-frequency effect did not and could not exist on high-tension transmission lines. On a line even a mile long it would require 250,000 kw. to maintain corona loss of the type suggested by Mr. Austin. In the opinion of Mr. Peek, the troubles from flashovers were due either to dirty insulators or to mechanical failures and could not be attributed to high-frequency phenomena of the kind referred to in the paper. He said that the flashover voltage due to lightning or switching is so high it could not produce flashovers on a transmission line because the losses are so large and because 60-cycle energy could not start or maintain 60,000-cycle effects.

F. G. Baum said that the first requirement of an insulator was mechanical strength and that Professor Smith had developed an insulator embodying many good principles. He thought that the suggestions of Mr. Austin meant changing line voltages and frequencies to conform to changing conditions, but economic and practical transmission design dictated an installation to meet the worst conditions encountered.

Years of experimentation on lines failed to discover any of the high-frequency effects described by Mr. Austin and led to the conclusion that these are absent. The test results indicate that the source of the troubles was either dirty insulators or a change in the insulating value of the air about an insulator.

R. J. C. Wood asserted that the Southern California Edison Company had gone to considerable trouble and expense in testing lines for high voltages, resonance effects and harmonics due to transients, but had been unable to find any voltage rise exceeding double line voltage and 90 per cent of these voltages were directly traceable to switching. They are insufficient to cause insulator flashovers.

A. W. Hillebrand said that shielding is a logical development which has a definite protective effect at 60 cycles and an even better effect at high frequencies. It reduces the gradient for exposed metal surfaces and will care for changing atmospheric conditions. He added that the further success of the insulator of Professor Smith would depend on commercial considerations as to its quality and cheapness in comparison with existing types.

E. M. Hewlett observed that the existing type of suspension insulator in combination with grading rings could be used for any conceivable transmission voltage.

Dr. J. B. Whitehead complimented Professor Smith on developing an insulator on the basis of a logical study of the properties of the arcing ring and dielectric field. The quality of the impregnation and the effect of atmospheric exposure would determine the life of the insulating member, and this really reduces to a question of the power of the surface of the insulating member to withstand the elements. An elastic effect of the impregnating material was a necessary quality to conform to its service requirements in wood under exposure.

C. E. Skinner declared that it seemed possible to secure an adequate impregnation of wood and that this would give the cheapness and mechanical strength associated with the use of wood.

Progress in Research and Electrophysics

ON WEDNESDAY afternoon several research papers prepared by the staff of the Norman Bridge Laboratory of the California Institute of Technology were presented. R. C. Burt gave a demonstration of the influence of temperature on photo-electric emission which showed that with pure surfaces temperature had no effect. Stanislaw Loria discussed atomic collisions in which atoms excited by orbital changes

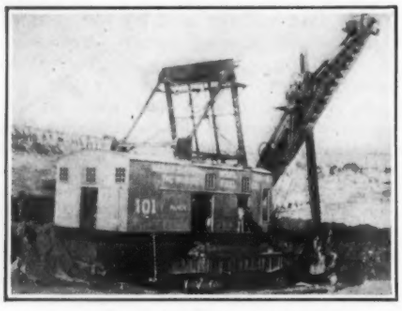
in electrons collide with other atoms before they became normal and radiate the energy associated with orbital changes.

S. S. MacKeown discussed research on electric currents due to fields alone, and E. C. Watson, A. L. Klein and W. R. Smyth presented other electronic researches. J. W. Du Mond described a slide rule for using the complex variable, and F. W. Maxstadt described a method for obtaining continuous high-voltage direct current. R. W. Sorenson then described the new million-volt transformer and later demonstrated its use for the benefit of the visitors.

After dinner Dr. R. A. Millikan gave a notable address on the astronomy of the atom and disclosed recent experiments which bore out the theories of Plank, Bohrer and others as to the orbital movements of electrons. He had been able to strip many atoms of their valence electrons and by computation predict spectroscopic lines which later experiments with the spectroscope showed were present.

Industrial Applications of Electricity

THE lumber industry on the Pacific Coast has used electric apparatus for only a short period, but sufficient experience has been obtained to show a big field for further development, J. L. Wright declared in his paper on this subject. Nearly every drive can be handled by a constant-speed motor, and 440-volt and 2,200-volt services predominate. The latest move is to standardize on 2,200 volts on motors of 40 hp. and over. The squirrel-cage induction motor is most favored with high-resistance rotor units, used where large starting torques are required. This results because of the rough service and the presence of dust and moisture. Magnetic controls generally prevail in the mills. The power factor is only about 65 per cent on most mills, and synchronous motors find ready application in sufficient capacity to give a notable corrective effect. A fir mill cutting rough timbers for cargo shipment uses about 40 kw.-hr. per 1,000 ft., while one cutting for rail shipment of finer work uses from 60 kw.-hr. to 70 kw.-hr. per 1,000 ft. The average kilowatt demand is about equal to one-half the connected horsepower load. A very complete discussion of all applications and of motors used in the industry was given in the paper.



LARGEST ELECTRIC SHOVEL EVER BUILT

A brief résumé of electric applications to all parts of the mining field was made by F. L. Stone. About 6,800,000 hp. of motive power is used in mining in this country. Of this, 1,603,000 hp., or 23 per cent, is supplied by central-stations and 1,206,000 hp. in motors, or 17.7 per cent, is run from privately owned electric plants. About thirty million dollars annually is paid central-station companies by mining companies. The load is variable, with a load factor usually below 50 per cent. Automatic substations are used freely and much electrical equipment is used for ventilation, hoisting, pumping and lighting. Electric locomotives are also used liberally. A trend is toward the use of 250-volt direct current for mine work, although 500 volts or higher has been used.

Electrical applications to the steel industry formed the subject of a good paper by K. A. Pauly. The author treated the subject broadly and gave statistics of the development. An outline of steel production methods was given, and a study was made of the desirable frequency, the utilization of waste heat and the utilization of central-station power.

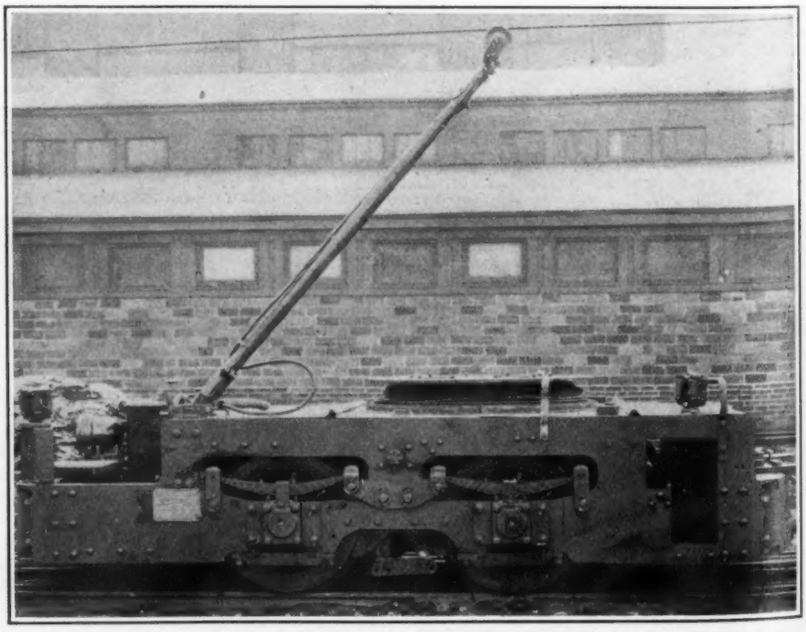
An admirable paper on electrical applications to irrigation pumping was given by R. H. Cates. He described the various types of pumping equipment that are now in use in California and enumerated the four general types of pumps in use, which are those installed in shallow pits where the water levels are within a few feet of the bottom of the pit and where water is delivered at the surface, those installed under similar conditions but delivering water into a pipe line with outlets at widely varying levels, those installed in deep wells with the well casings beginning at the surface of the ground and where water may be delivered at the surface or into pipe line with varying heads, and those pumping from a reservoir or tank on the surface to a reservoir or tank at a higher level.

An interesting service rendered to the pumping customers of the Southern California Edison Company, and one given free of charge, is the testing of consumers' pumping equipment. These tests include standing water levels, pumping water levels, total lift, water delivered, kilowatt input to motor, over-all efficiency, pump efficiency, kilowatt-hours per acre-foot of water, and percentage of full-load input to motor. These tests are worked up, and a complete report is submitted to the consumer with recommendations that will improve his efficiency or lower his unit cost of delivering water to his lands.

In discussing the paper by R. H. Cates on "Electrical Applications to Irrigation Pumping," L. J. Moore said that the San Joaquin Light & Power Corporation, as well as other companies, also furnishes a free testing service for irrigation consumers to assist them in checking up on the efficiency of their pumps. His company now has a total of 6,495 agricultural consumers with a connected load of 75,898 hp., or an average connected load of 12.1 hp. per consumer. In the San Joaquin Valley of California there are 370,000 acres under irrigation, he asserted.

The point was brought out by Ralph Bennett that standard motors are suitable for irrigation pumping, but that a different type of starting equipment is often required to avoid surges in pipe lines due to the motor accelerating too rapidly and non-uniformly.

The opinion was expressed by E. B. Rosenblatt that there is too much rule-of-thumb method in making electrical applications in the lumber industry. The power factor of sawmill loads is bad, he said, and he suggested the use of synchronous motors for other uses than driving fans about the mill. Little progress seems to have been made in electrifying the saw carriage in mills, and he spoke of one mill in Washington where an attempt will be made to adapt high-speed elevator equipment to this service.



FOUR-TON GATHERING LOCOMOTIVE WITH EQUALIZING LEVERS AND CABLE REEL (STONE)

Electrochemistry and Electrometallurgy

ON THURSDAY afternoon two excellent papers on electrochemistry and electrometallurgy were presented.

The electrical equipment in a zinc plant was described in a paper by R. N. Lockyer. Electrolytic zinc is produced by the use of synchronous motor-generator sets, which afford a load of high power factor. The paper was valuable for its very detailed description of a modern installation.

In a paper on electrometallurgical applications, J. L. McK. Yardley dealt with a field of engineering in which electrical, chemical and metallurgical engineers are all becoming more interested. He considered only metals, such as iron, zinc, copper, nickel, aluminum, etc., which are ordinarily employed in construction or manufacture and in the production of which large quantities of electric power are employed. From a consideration of the various items of the total heat appearing in the smelting or the electrolytic process it is apparent that the only really useful energy is that taking part in the final or main reaction, or that energy anywhere else in the process that tends to reduce the amount required in the main reaction. The useful heat is a small part of the whole, and all the various losses and secondary reactions must be taken into account in determining the over-all economy. The energy required for electric smelting is a function of the amount of furnace charge, whereas the energy required for electrolysis is a function of the amount of metal deposited. In Norway and Sweden there has been extensive economic electric smelting of zinc. Here the raw material employed has been high in the values produced. The power consumed is from 2 kw.-hr. to 2.5 kw.-hr. per pound of zinc in units of about 1,000 kw. capacity.

The discussion accented the advantage of using rotary converters instead of motor-generator sets for the supply of continuously operating electrolytic plants using large amounts of energy because of their higher efficiency. C. J. Russell urged electrical engineers to take a more active interest in industrial applications of electricity and urged greater attention to the securing of high power factor on industrial loads.

Street Lighting and Telephony

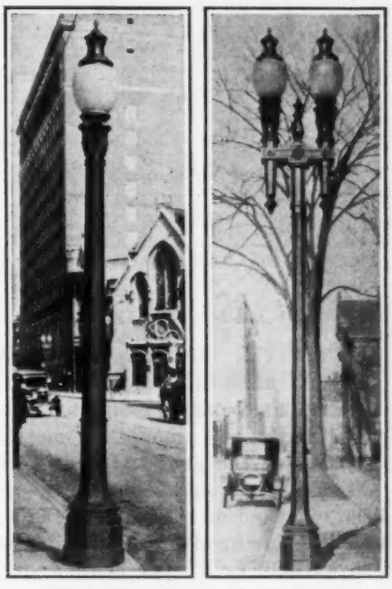
THE closing session on Friday morning was devoted to telephony and street lighting.

A good paper on street lighting as a municipal problem was presented by R. D. Whitney. A general description of the street-lighting installation in Syracuse was followed by a detailed discussion of the economic, political and practical considerations faced by consulting engineers in the street-lighting business. The recent report of the New York State Committee on Street Lighting was included in the paper.

A mathematical investigation of wave propagation along wires to determine the guided and radiated energy values was presented by J. R. Carson. Simple transmission theory has been found inadequate, and the research made further substantiated the author's previous conclusions that radiation of energy does not involve attenuation of the guided wave and that the explanation is to be found in the existence of effects unrecognized in elementary theory.

Practical transmission-line maintenance methods in a telephone system were outlined in a paper by W. H. Harden. Toll-circuit maintenance, listing methods and other items of maintenance were outlined. An analysis of common troubles and their effect on transmission was included.

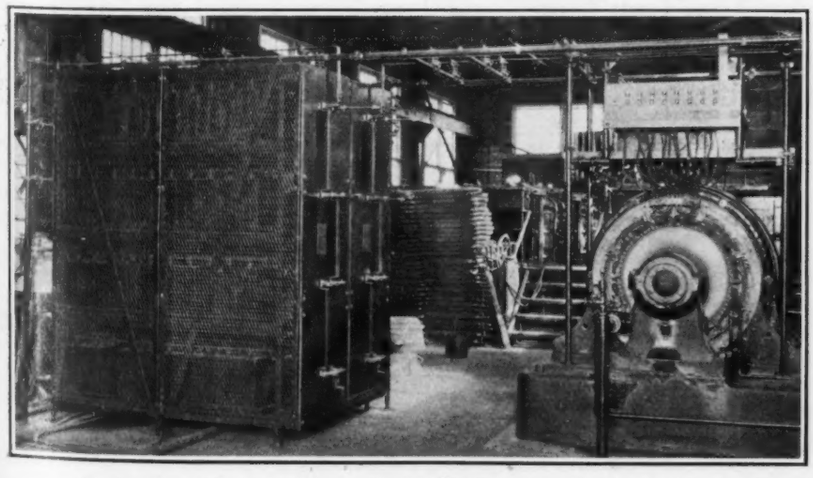
The determination of magnitude and location of telephone circuit unbalances was considered in a paper by L. P. Ferris and R. G. McCurdy. The maintenance of telephone circuits in a high state of efficiency with respect to balance is important since unbalances contribute to cross-talk between telephone circuits and to noise when such circuits are involved in inductive exposures. While the effect of unbalances depends much upon how and where the circuit is energized and on the energization and condition of other nearby telephone circuits, the test methods which have been devised permit the detection of all important unbalances which may contribute to noise. All of the apparatus for applying these methods has been standardized and made up in portable form for convenience in field testing. Much of it has been in use for several years. The development of this apparatus and the methods outlined in the paper provide the operating telephone companies with effective means for detecting faults of balance and for maintaining circuits in a high state of efficiency from this standpoint.



TWO TYPES OF LIGHTING STANDARDS USED IN SYRACUSE

These methods are particularly applicable to toll circuits, but some of them can also be applied to local circuits where necessary. This is important in minimizing cross-talk over telephone circuits and interference by noise when such circuits are raised above the potential of the earth by induction from neighboring power circuits. Further investigations of unbalances are in progress to determine more definitely the relationship between the magnitude and location of unbalances and their resultant effect at the circuit terminals when the circuits are energized inductively.

In discussing the papers D. I. Cone said that the new instruments developed for testing balance had proved very valuable and had been widely used. J. E. Woodbridge said the steps to secure completely balanced telephone circuits were noteworthy and would render them immune from inductive interference. Other discussion covered details of balance tests and specific experiences. The discussion on street lighting accented its importance as a community asset whereby good will, revenue and appearance all were involved.

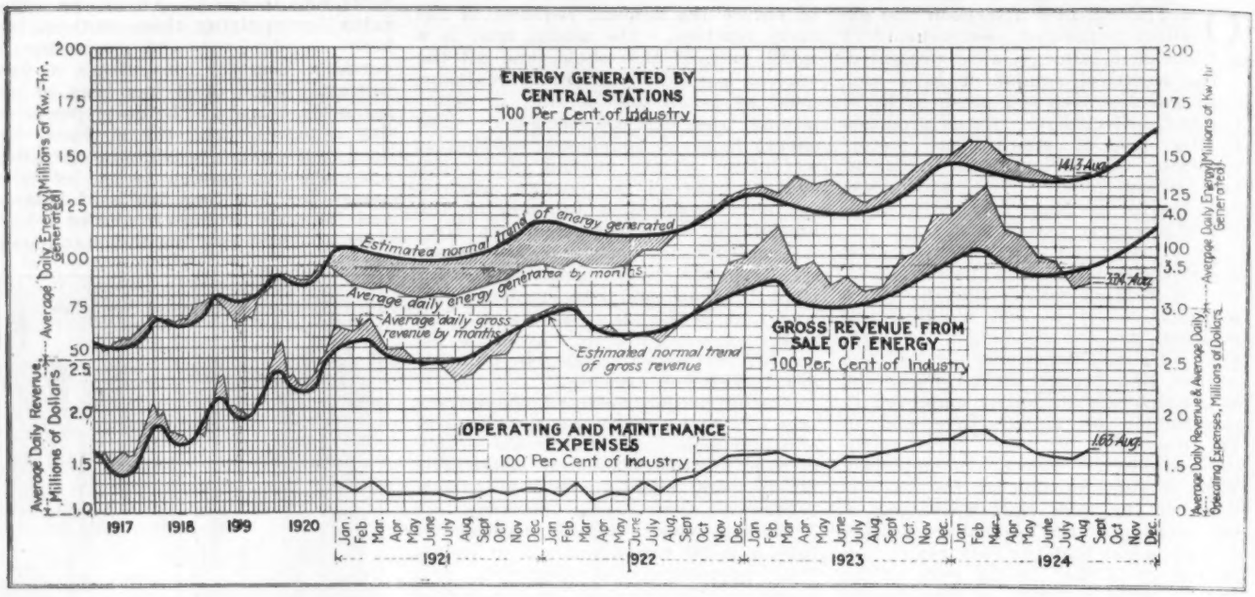


ELECTROLYTIC IRON REFINERY WITH CAPACITY OF 15 TONS PER MONTH

Entertainment

As a climax to the fine entertainment program a banquet was given on Friday night at which S. G. McMeen was toastmaster. Several prominent engineers and pioneers spoke.

Improved Central-Station Activity During August


ENERGY GENERATED BY CENTRAL STATIONS
100 Per Cent of Industry
Estimated normal trend of energy generated
Average daily energy generated by months
GROSS REVENUE FROM SALE OF ENERGY
100 Per Cent of Industry
Average daily gross revenue by months
Estimated normal trend of gross revenue
OPERATING AND MAINTENANCE EXPENSES
100 Per Cent of Industry
Average Daily Energy, Millions of Kw.-Hr. Generated
Average Daily Revenue, Millions of Dollars
Average Daily Revenue & Average Daily Operating Expenses, Millions of Dollars
1917
1918
1919
1920
1921
1922
1923
1924

ACTIVITY during August as reported by the central-station industry was slightly above the ELECTRICAL WORLD'S estimated point of normal activity in so far as the amount of energy generated was concerned, but the gross revenue received during August was 7.4 per cent below what would normally have been expected of the industry as a whole. The revenue received during August totaled $100,300,000, which was $26,500,000, or 21 per cent, under the record revenue received in January. Notwithstanding these adverse facts, the gross revenue of the industry in August was 6.3 per cent above that for the same month last year.

The amount of energy consumed by power customers continued below last year, but the increased consumption for lighting purposes was sufficient to bring the consumption to 1.5 per cent above August of last year.

TABLE III — OPERATIONS OF CENTRAL-STATION HYDRO AND FUEL POWER PLANTS IN THE UNITED STATES
(100 per Cent of the Industry)

Month	Energy Generated				Fuel Consumption		
	Hydro Plants		Fuel Power Plants				
	Thousands of Kw.-Hr.	Per Cent	Thousands of Kw.-Hr.	Per Cent	Coal, Short Tons	Oil, Barrels	Gas, Thousands of Cubic Feet
1924							
*June	1,671,418	39.9	2,523,573	60.1	2,295,124	1,302,703	4,176,288
*July	1,579,346	37.1	2,674,523	62.9	2,402,157	1,390,022	4,959,046
*Aug	1,494,817	34.1	2,886,212	65.9	2,569,634	1,457,491	5,289,742

*As collected by United States Geological Survey. The data are for the electric light and power industry only.

TABLE I—GENERATION AND DISTRIBUTION OF CENTRAL-STATION ENERGY IN THE UNITED STATES
(100 per Cent of the Industry)

Month	Kw.-Hr. Generated Monthly			Distribution of Energy Generated										Energy Purchased by Public Utilities for Resale, Kw.-Hr.	
				Total Energy Consumption by Central-Station Customers, Kw.-Hr.		Energy Consumed for Lighting Kw.-Hr.		Energy Consumed for Power Kw.-Hr.		Energy Sold to Electric Railways Kw.-Hr.		Energy Used in Intra-Company Business Including Line Losses, Kw.-Hr.			
	1924 Thousands	1923 Thousands	Per Cent Inc.	1924 Thousands	1923 Thousands	1924 Thousands	1923 Thousands	1924 Thousands	1923 Thousands	1924 Thousands	1923 Thousands	1924 Thousands	1923 Thousands	1924 Thousands	1923 Thousands
June	*4,194,991	4,164,327	0.8	3,385,991	3,360,827	1,021,000	887,000	1,850,991	1,990,827	514,000	483,000	809,000	803,500	692,990	600,200
July	*4,253,869	4,179,631	1.7	3,432,869	3,371,631	1,032,000	897,000	1,860,869	1,967,131	540,000	507,500	821,000	808,000	660,000	535,000
Aug	*4,381,029	4,316,906	1.5	3,553,429	3,484,406	1,075,000	933,500	1,938,429	2,043,406	540,000	507,500	827,600	832,500	690,000	552,000

* Data on "energy generated" are those collected and published by the United States Geological Survey for all public utilities, minus such data as are collected on energy generated by electric railway companies, reclamation service and manufacturing plants. The data are, therefore, for the electric light and power industry only.

TABLE II—CENTRAL-STATION FINANCIAL OPERATIONS FOR THREE MONTHS IN THE UNITED STATES
(100 per Cent of the Industry)

Month	Gross Revenue from Sale of Energy†			Operating and Maintenance Expenses‡			Operating Ratio					
							Steam Plants		Hydro Plants		Combined Steam and Hydro Plants	
	1924 Thousands	1923 Thousands	Per Cent Increase	1924 Thousands	1923 Thousands	Per Cent Increase	1924	1923	1924	1923	1924	1923
June	$103,700	$97,600	6.3	$46,800	$43,700	7.3	52.1	54.1	26.9	34.0	46.4	43.3
July	99,300	93,800	5.9	49,100	45,400	8.1	56.1	55.3	28.1	27.9	48.1	46.1
Aug	100,300	94,300	6.3	50,600	46,900	7.6	53.7	55.2	25.2	29.4	51.3	50.3

† Aggregate gross revenue from actual consumers and sales to other public utilities for resale, involving a certain amount of duplication.
‡ Do not include interest, taxes, depreciation or sinking fund.

High-Intensity Illumination

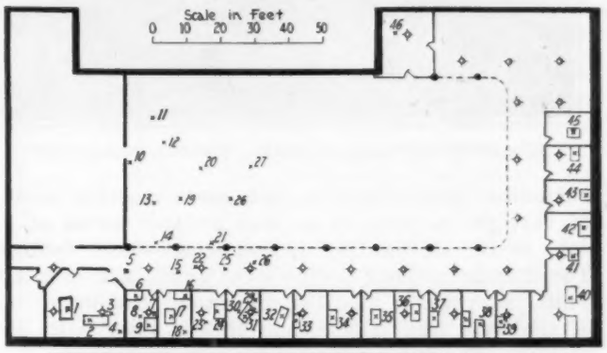
McGraw-Hill Company's Offices and Plant in New York Recently Equipped with Modern High-Intensity Lighting System—Nine Distinct Major Problems Encountered, Requiring Many Types of Equipment

THERE has just been completed in the offices and plant of the McGraw-Hill Company, Inc., publisher of the ELECTRICAL WORLD and other technical and industrial magazines, a lighting installation which contains many features of interest and which makes a commendable contribution toward putting into practice higher illumination intensities. In both office and plant intensities from 15 foot-candles to 30 foot-candles have been obtained, and it is hoped that future production records in the print shop, compared with those under the former system of lighting, may give additional definite proof of the relation of intensity of illumination to production. At the same time the attempt has been made to apply all the principles of good illumination to the various problems with which the illuminating engineers were confronted in this particular piece of work.

The Hill Building, which houses the offices and plant of the McGraw-Hill Company, is at Tenth Avenue and Thirty-sixth Street in New York, well away from other high buildings, and its window space is wonderfully well arranged for daylight illumination. Some of the floors are occupied by tenants, the McGraw-Hill Company itself occupying the first, seventh, part of the eighth, the tenth, eleventh, twelfth (with mezzanine) and thirteenth. Both the seventh and the eleventh floors accommodate two departments each, quite distinct in character, so that these seven floors presented nine separate and individual major illuminating problems.

With the growth of the company's activities and the increasing demand made upon the artificial lighting installation, it became evident recently that the former installation, particularly in view of recent developments in illumination, was entirely inadequate and out of date. The attitude and work of the ELECTRICAL WORLD in the development of modern illumination are well known to its readers, and its editors suggested to the officials of the McGraw-Hill Company that any revision of the illumination should be made with the determination to follow the very best practices. It was felt by the officials of the company that the lighting installation should be fully representative and reflect the best knowledge and skill of the illuminating industry. Naturally recourse was had to the manufacturers of incandescent lamps, from whom it was felt unbiased advice would be forthcoming, and a committee of their engineers was prevailed upon to undertake the responsibility of laying out an illumination plan. This committee consisted of M. Luckiesh, director of lighting research, Nela Park, Cleveland; George H. Stickney, illuminating engineer, Edison Lamp Works of General Electric Company; Samuel G. Hibben, illuminating engineer, Westinghouse Lamp Company, and Ward Harrison, illuminating engineer, National Lamp Works of General Electric Company. These men were aided by assistants in field work and calculations, among whom should be mentioned especially F. J. Cadenas of the Westinghouse Lamp Company and R. B. Kellogg of the Edison Lamp Works.

No reference need be made here to the former lighting except to say that in many places it was above the average practice, but even then was insufficient to meet the needs of the situation. Reference to the "before" pictures accompanying this article will give some indication of the former scheme of illumination.



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Old reading			1	2	4	4	1	2		6.8	4.8	7	7.2		4	1
New reading	16.0	14.3							15.0							
	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
Old reading	2	3	6.1	6.9	4.5	5	2	1	12	10.2	6	17	15.1	14.8		
New reading								10							16.9	
	33	34	35	36	37	38	39	40	41	42	43	44	45	46	4	
Old reading																
New reading	16.3	13.5		12.7	12.7		12.7	13.2	13.7		13.2	12.8		16.1		

PHOTOMETER READINGS OF TWELFTH FLOOR, MAIN EDITORIAL OFFICES; CEILING HEIGHT MAIN ROOM 23 FT.

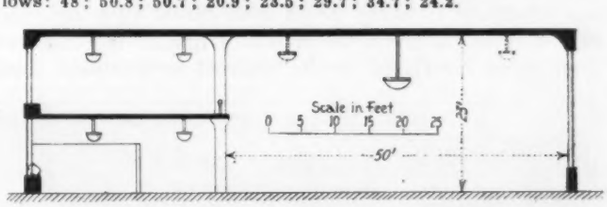
Main Editorial Space—Six special luminaires, each containing three "X-Ray" mirrored-glass "Jumbo" reflectors No. 54; 1,500-watt "Mazda C" lamps for tip-up burning; watts per square foot, 4.8.

Offices Under Mezzanine and Open Spaces on Mezzanine—Illuminated-bowl indirect luminaires using "X-ray" mirrored glass "Jumbo" reflectors No. 54; with 750-watt "Mazda C" lamps for base-up burning. Watts per square foot, 2.2.

Executive Offices on Mezzanine—Duplexalite D-531 with shade; 500-watt "Mazda C" lamps.

New readings at points spotted in the diagram not available at time drawing was made were as follows: No. 10, 26.1; No. 11, 20.8; No. 13, 20.7; No. 19, 30.8; No. 21, 20.9; No. 26, 33.6.

New readings at points not spotted on the diagram are as follows: 48; 50.8; 50.7; 20.9; 23.5; 29.7; 34.7; 24.2.



CROSS-SECTION OF TWELFTH FLOOR WITH MEZZANINE, SHOWING THE RELATIVE LOCATION OF LUMINARIES AND DIMENSIONS OF THIS PRINCIPAL ROOM

TWELFTH FLOOR—MAIN EDITORIAL ROOM

By far the most difficult problem which presented itself was the main editorial room, occupying the twelfth floor, with a mezzanine, and housing the editorial and business offices of eight publications, as well as one or two other departments and, on the mezzanine, the executive offices of the company. This room is shown in cross-section, plan and photograph. The north wall is for the most of its length entirely occupied by window space, which not only does not provide any means for

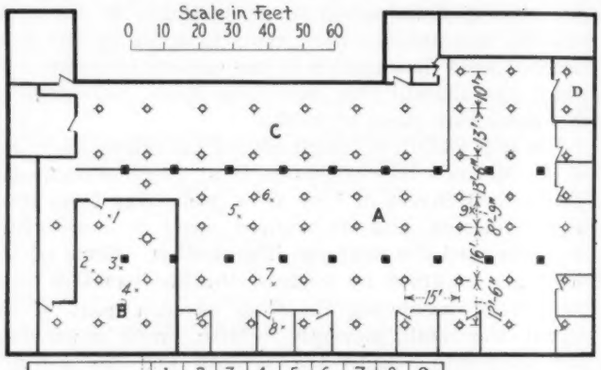
THE SEVENTH FLOOR EDITORIAL OFFICES IN DAYLIGHT

horizontal light reflection, but allows a large amount of daylight to come in at that critical period of the day, so far as lighting is concerned—early twilight. The mezzanine floor occupies the south and east side. Thus, as regards lighting reflection, the lower half of the west wall is left, and this is lined with book shelves. The ceiling, therefore, remains the principal surface from which any light reflection can be obtained. Fortunately, the ceiling provides a good surface, containing as it does a flat panel, 30 ft. x 105 ft., painted white. In the center of this panel are six openwork rosette designs on 15-ft. centers. They were once used for ventilators, but are not now in use. The floor space is occupied by highly polished mahogany desks and file cabinets, which are instrumental in producing reflected glare when viewed under direct lighting or semi-indirect lighting from brilliant sources. Clerical work of a detailed nature is done in practically all positions on this main floor. Another feature which imposed a limitation on lighting plans for this room is that workers on the mezzanine floor are in such position that luminaires suspended from the main ceiling are in their direct line of vision.

With these various limitations, which precluded the use of direct lighting or of semi-direct lighting from very brilliant sources, the choice of luminaires was soon seen to be restricted to the indirect or modified semi-indirect type. In either case almost entire dependence had to be placed on the ceiling. This had the advantage that the even brightness of the ceiling would eliminate objectionable reflected glare from the highly polished desk tops, cabinets and windows.

Several experiments were performed, and finally an elaborate experimental luminaire framework was constructed and equipped in order to determine the best type of luminaire to use. At this time it was found that a further limitation was imposed by the mezzanine floor and that the maximum distance that the luminaire could be suspended from the ceiling was determined by the position of the eyes of those on the mezzanine, it being important that they be unable to look down into the reflectors in the luminaires or to see the lamps directly. Thus 6 ft. was the maximum distance of suspension.

After considerable experimenting, it was determined to use six luminaires of somewhat special design, each to be hung from one of the six rosettes on the center line of the ceiling. While there were two rows of out-



	1	2	3	4	5	6	7	8	9
Old reading	4	6	2.5	4.5	9	3.5	6	5	
New reading	15.8	11.3	12.5	13.6	11.7	7.0	11.3	7.4	15.0

PHOTOMETER READINGS OF SEVENTH FLOOR, EDITORIAL OFFICES AND DRAFTING ROOM; CEILING HEIGHT 14 FT. 2 IN.

Section A, Editorial Room—"Duplexalite" D-531, installed 30 in. from the top of the edge of the reflector to the ceiling; 500-watt "Mazda C" lamps; watts per square foot, 2.60.

Section B, Mailing Room—Bailey "Equalite" luminaires; 300-watt "Mazda C" lamps.

Section C, Drafting Room—"Duplexalite" D-1031; 750-watt "Mazda C" lamps (except rear six units over photographic room, which are Bailey "Equalite" luminaires; 300-watt "Mazda C" lamps). Drafting section, watts per square foot 4.000.

Section D, Private Office—Equipped with two "Duplexalite" D-531 luminaires; 500-watt "Mazda C" lamps.

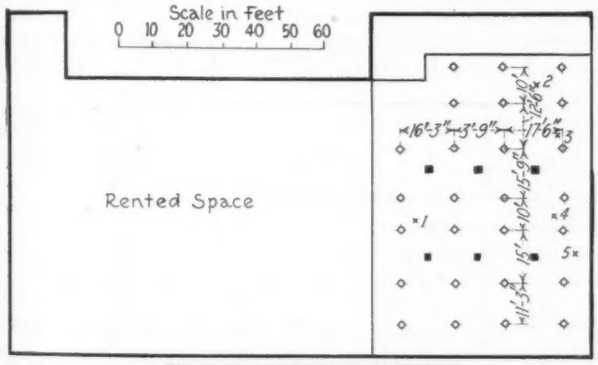
THE EVEN ILLUMINATION IN THESE EDITORIAL OFFICES ON THE SEVENTH FLOOR UNDER THE NEW INSTALLATION CONTRASTED WITH THE OLDER ILLUMINATION SHOWN ON THE LEFT

Comparison with the daylight picture on this page shows much more uniform distribution than under daylight.

sets of seven each which had housed the earlier lighting system, located along the edge of the ceiling, it was found impracticable and inefficient to use these because only half of their light would be reflected from the ceiling, the other half falling on rough non-reflecting surface which it was impracticable to cover with a white reflecting paint. The six luminaires as located give slightly higher illumination along the center line than at the sides, but in general produce a very even illumination over the entire open area of this twelfth floor.

Each luminaire consists of a 42-in. bowl holding three X-ray mirrored glass "Jumbo" reflectors, No. 54, equipped with 1,500-watt "Mazda C" lamps. It was impossible to adhere to the standard of base-up burning on account of the limitations of suspension height, and accordingly these luminaires are designed for tip-up burning.

On this same twelfth floor, underneath the mezzanine, is a row of offices of editors and business managers of the publications, as shown on the accompanying plan. These offices, 10 ft. x 12 ft., are divided by partitions, the lower half of which is mahogany and the upper half clear glass. The partitions are about 7 ft. 6 in. high, leaving open space above. Between the offices and the row of columns is additional office space



	1	2	3	4	5
Old reading	2	35	23	25	2
New reading	16.6	22.2	19.0	20.2	18.3

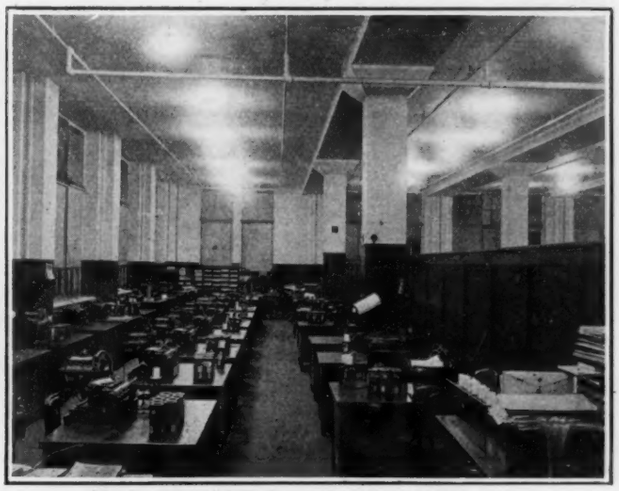
PHOTOMETER READINGS OF EIGHTH FLOOR, STENOGRAPHIC DEPARTMENT; CEILING HEIGHT 14 FT. 2 IN.

Equipped with "Sol-Lux" luminaire 351625, using 500-watt "Mazda C" lamps in the east row over the stenographic operators and 300-watt "Mazda" lamps over the rest of the room, which is devoted to general purposes; watts per square foot: Stenographic department, 2.69; general department, 1.59.

A DAYLIGHT VIEW OF THE STENOGRAPHIC DEPARTMENT, EIGHTH FLOOR, SHOWS THE WINDOW SPACE TO BE CONSIDERED IN DESIGNING ARTIFICIAL LIGHTING

occupied primarily by secretaries. The ceiling over this is also glossy white, corresponding to the ceiling of the main editorial room, and is 11 ft. 6 in. high. The south wall is almost entirely glass windows, so there is no reflecting side wall. Outlets for lighting are located according to the normal bays of the building and have no relation to the location and size of the offices. It was found impracticable to rewire the building—the office partitions are not of a permanent character—and, furthermore, it was found perfectly practicable to design a lighting installation using the present outlets. Again, the choice was limited to an indirect luminaire or one of a semi-indirect type of low intensity so far as the visible portion was concerned. To conform with the units in the main editorial offices, luminaires using X-ray mirrored glass "Jumbo" reflectors, No. 54, with 750-watt "Mazda C" lamps for base-up burning, were used. This reflector allows enough light to go through an opening in its bottom to give good illumination to the glass bowl of the luminaire itself. Similar equipment was placed on the ceiling of the mezzanine, which presented a problem almost identical with that found under the mezzanine.

The results of this system of illumination on the twelfth floor and mezzanine are shown on the accompanying plans in foot-candle readings taken at different positions over the floor and in the offices. The general



CONTRAST OF THE OLD WITH THE PRESENT ILLUMINATION, EIGHTH FLOOR, STENOGRAPHIC DEPARTMENT

DAYLIGHT VIEW THIRTEENTH FLOOR, SUBSCRIPTION AND ACCOUNTING DEPARTMENTS

effect in this room and in the office is that there is plenty of light, but it is doubtful whether any one will ever say that there is too much. Intensities for office work ranging from 15 foot-candles to 25 foot-candles are not yet common in artificial illumination, and since this particular installation has just been completed, no judgment on its effectiveness can yet be made; but it is expected that it will prove its benefits through decreased strain upon the eyes of the workers and improvement of general psychological "morale" of the organization.

The private offices on the mezzanine presented no problem different from the usual private office with one central outlet. They are all 14 ft. x 17 ft. with an 11-ft. ceiling, except one office which is twice that size and has two outlets. One semi-indirect luminaire, Duplexalite D-531, with 500-watt "Mazda C" lamp for base-up burning, is used in each of these outlets.

SEVENTH FLOOR—EDITORIAL ROOM

On the seventh floor of the building are editorial and business offices of four papers, similar to those found on the twelfth floor. The particular space under question is marked "A" on the plan of the seventh floor, shown herewith. Here the ceiling height is 14 ft. 2 in. and the ceiling is white. Again, on the east and south the walls are mostly windows. Pillars divide the room into 15-ft. x 24-ft. bays, and there are two outlets per bay as noted. There are also eight individual private offices similar to those under the mezzanine on the twelfth floor.

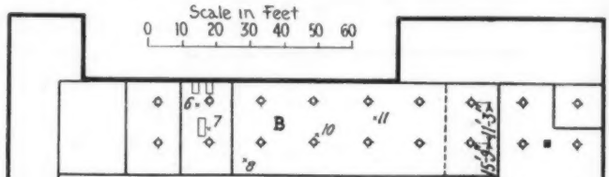
PRESENT ILLUMINATION THIRTEENTH FLOOR

Again the engineers were confronted with shiny-top mahogany desks and limited to semi-direct units with low intensive brilliancy of visible lighted areas. To meet this condition, "Duplexalite" D-531 fixtures, with gold-finished reflector and deep amber diffusing disk, each equipped with 500-watt "Mazda C" lamps, were used. These were suspended a distance of 30 in. from the top edge of the reflector to the ceiling. The resulting foot-candle intensities are shown in the table accompanying the plan of the floor.

The evenness of the illumination and its thoroughly diffused and soft, inviting tone have continually since its installation brought forth high commendation from all who have worked under it or have examined its final effect.

DRAFTING ROOM

Section C on this floor is devoted to the drafting room, where drawings for the various magazines are made and illustrations retouched. This room is formed by the windowed north wall, the blind west wall and a 9-ft. stippled-glass partition on the east and south sides, the woodwork of which is dark mahogany. The



	1	2	3	4	5	6	7	8	9	10	11	12	13
Old reading	4	3	4	5	2.5	7	6.5	7	4	9	6.5	4.5	2.25
New reading	5.3	9.9	6.8	12.6	8.6	12.1	11.7	11.2	10.7	14.9	13.6	10.4	11.2

PHOTOMETER READINGS OF THIRTEENTH FLOOR, ACCOUNTING AND CIRCULATION DEPARTMENTS; CEILING HEIGHT 12 FT. 6 IN.

Sections A and B, Accounting and Circulation Departments—Bailey "Equalites"; 300-watt "Mazda C" lamps; watts per square foot, 1.45.

Sections C and D, Addressograph and Filing—"Ivanhoe Trojan" No. 5264X, 16 in.; 300-watt "Mazda C" lamps; local illumination for addressograph machine provided by mill-type deep-bowl reflector No. 351544, with 50-watt mill-type "Mazda B" lamp, mounted on Anderson arms.

ceiling is white, and there are two outlets per bay as on the rest of the floor. It should be remarked that the previous installation in this particular room depended almost entirely upon local lighting, with resulting inequality of distribution and many noticeable shadows. An installation providing general illumination was decided upon to meet the following requirements: (1) Even distribution of well-diffused, high-intensity lights; (2) a minimum number of shadows, as deep ones make it difficult to follow fine lines when working close to the T-square or triangle. Accordingly, "Duplexalite" D-1031 fixtures, equipped with 750-watt "Mazda C" lamps for base-up burning, were decided upon, to be suspended 30 in. from the top of the reflector to the ceiling.

The rear part of this room is used for a photographic

department, and artificial light is needed only for rapid work in setting up a job. Six Bailey "Equalite" luminaires, already in use elsewhere in the building, were moved to this location to provide this illumination.

THIRTEENTH FLOOR—ACCOUNTING AND CLERICAL DEPARTMENTS

The thirteenth floor houses two departments which are separated from each other merely by a wire-mesh partition or fence, so that the problems faced were really one. The upper walls and ceiling have a white-gloss finish. The side walls are almost entirely window space. The ceiling height is 12 ft. 6 in. This room has excellent daylight because in addition to the side wall windows there are three large skylights centrally located. The former artificial system consisted of "Frinklite" luminaires equipped with 200-watt "Mazda C" lamps, and on account of the ceiling height and the extensive open area of this room, many of these were in the direct line of vision of most of the workers, and there was considerable complaint. Actual intensities varied from 4½ foot-candles to 9 foot-candles, but on the vertical plane, where considerable work is done, intensities as low as 2½ foot-candles were found.

The engineers were not confronted with reflection from desks in this room, as linoleum-top desks are used in the main. Because of all these facts they recommended a luminaire providing a wider spread of light, and these were found in Bailey "Equalites" equipped with 300-watt "Mazda C" lamps for base-up burning. In this department there has been perhaps even more comment on the improved illumination than in any other of the office departments.

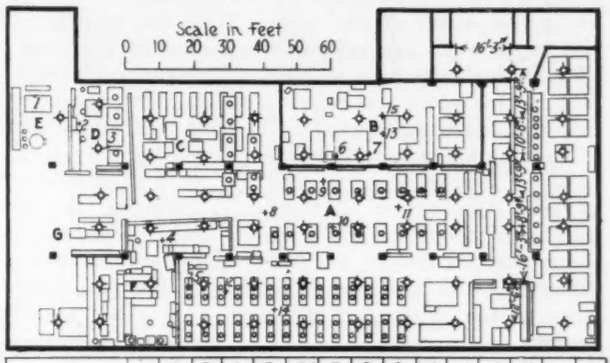
EIGHTH FLOOR—STENOGRAPHIC DEPARTMENT

On the eighth floor there is principally the stenographic department, with a personnel of dictaphone transcribers and typists and in addition some general office workers. The work in a room of this sort is naturally close, and the former intensity of 2 foot-candles to 3.5 foot-candles was materially low. On this floor, too, rather high-intensity small-globe luminaires were in use, and many of these were in the line of vision of most of the workers.

On account of the shape of the various parts of this room, the ceiling height, the windows on the east and south walls, and to produce a high level of well-diffused light, the engineers recommended the use of the "Sol-Lux" luminaire No. 351625, ceiling type, using 500-watt "Mazda C" lamps. In that part of the room not occupied by stenographic operators 300-watt lamps were found to give sufficient illumination.

ELEVENTH FLOOR—PURCHASING OFFICE

The only other office space of the company, except a few minor small offices where no particular illumination problem was presented, is the purchasing department, which occupies a part of the eleventh floor marked "B." This office has a white ceiling, but its walls are virtually useless so far as reflection is concerned. In making a recommendation for this room it was necessary to recognize its proximity to the composing room with the



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Old reading		6	7	3	2.3	5.2	3.2	5.2	4.8	5.1	5.0				
New reading	1.4	17.0	18.0	7.6	12.0	15.6	22.0	12.9	15.3	14.9	15.1	8	17.4	11.2	17

PHOTOMETER READINGS OF ELEVENTH FLOOR, COMPOSING ROOM; CEILING HEIGHT 14 FT. 2 IN.

Section A, Composing Room—20-in. Benjamin "Glassteel" diffusers, with 300-watt "Mazda C" lamps, for general illumination; local illumination provided over make-up stones with 14-in. "RLM" standard-dome reflectors mounted 3 ft. above the surface of the stone equipped with 100-watt bowl-enameled "Mazda C" lamps; type racks each equipped with two mill-type dome reflectors. No. 353017, with 50-watt bowl-enameled mill-type "Mazda B" lamps; watts per square foot: General, 2.40; total, 2.75.

Section B, Purchasing Department—"Cora-lite" No. 2112; 500-watt "Mazda C" lamps.

Section C, Job and Press Room—Over the presses, 18½-in. "RLM" standard domes; 500-watt bowl-enameled daylight "Mazda C" lamps; the rest of the illumination as in Section A.

Section D, Monotype Room—18-in. "RLM" standard-dome reflectors; 500-watt bowl-enameled "Mazda C" lamps.

Section E, Melting Furnace—16-in. "RLM" standard-dome reflectors: 200-watt bowl-enameled "Mazda C" lamps.

Section F, Cutting Room—General illumination, 18-in. "RLM" standard-dome reflectors; 300-watt bowl-enameled "Mazda C" lamps; local lighting, near the windows over the machines, deep-bowl mill-type reflectors, No. 351544, with 50-watt bowl-enameled mill-type "Mazda C" lamps.

Section G, Elevator Space and Files for Cuts 16-in. "RLM" standard-dome reflectors; 200-watt bowl-enameled "Mazda C" lamps.

COMPOSING-ROOM ILLUMINATION "BEFORE" AND "AFTER"

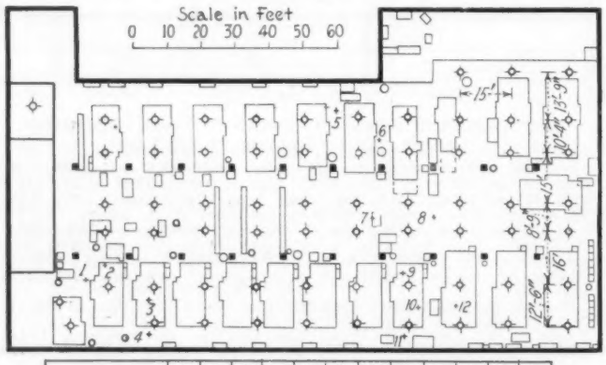
The results of changing from low-level general illumination and frequently handled local illuminating units to high general illuminating levels with these "Glassteel" units, aided by well-placed fixed local units, is strikingly apparent here.

accompanying dust. Opalescent glass inclosing globes were therefore thought to be best adapted to the problem, in spite of the fact that there is some reflection on the desk tops—not so much as in the editorial offices. The units adopted were the "Cora-lite" No. 2112, equipped with 500-watt "Mazda C" lamps. These units were mounted in suspension-type holders, allowing 12 ft. from the bottom of the luminaire to the floor.

COMPOSING ROOM

By far the most interesting problem aside from the twelfth floor presented itself in the eleventh floor, the composing room. A study of the plan of this floor indicates the layout of the linotype machines, the type racks along the south side of the room and the make-up tables along the center of the room. With the exception of the upper walls and ceiling, everything in the room is of very dark finish or is black. The general illumination in this room was previously low, most dependence being placed upon frequently handled local illuminants.

The engineers suggested two plans—one a system of localized general lighting and the other high-intensity general illumination. After experimenting, the first plan was adopted. It is as follows: The general illumination consists of 20-in. Benjamin "Glassteel" diffusers, with 300-watt "Mazda C" lamps, installed close to the ceiling. This gives a general intensity approximating 9 foot-candles independent of all local lighting. For local illumination, one 14-in. "RLM" standard-dome reflector is mounted over each make-up "stone," suspended at a height of 3 ft. above the surface and equipped with a 100-watt bowl-enameled "Mazda C" lamp. These produce the necessary intensities, the minimum being 5 foot-candles at the extreme edge of the stone, which is in addition to the 9 foot-candles provided by the general illumination.



	1	2	3	4	5	6	7	8	9	10	11	12
Old reading	4	3	4.5	5.5	2	12	4.5	4	18	5	8	3.5
New reading	17.8	3.5*	30.2*	30.3	9.8	9.5	17.5	18	15.8	15.6	30.3	34.2

* Under Press + On top of Press

PHOTOMETER READINGS OF TENTH FLOOR, PRESS ROOM; CEILING HEIGHT 14 FT. 2 IN.

Equipped with 18½-in. "RLM" standard domes, using 500-watt daylight bowl-enameled "Mazda C" lamps over each of the two rows of presses and 300-watt daylight bowl-enameled "Mazda C" lamps over two center rows; average watts per square foot, 2.35.

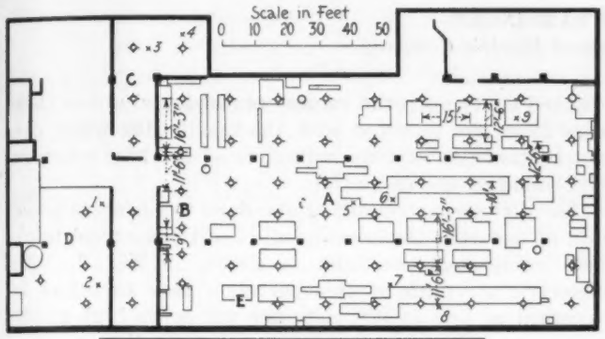
LOCAL DIFFUSING UNITS ON THE TYPE RACKS

In the effort to minimize possible shadows over the racks for hand composition a small luminaire similar to the "RLM" standard dome was used—this being the mill-type dome reflector No. 353017 as manufactured by the George Cutter Works. These are equipped with 50-watt bowl-enameled mill-type "Mazda B" lamps, adding about 5 foot-candles to the general illumination over these frames. One local lamp for the keyboard of each linotype was naturally installed.

The accompanying illustrations show some of the results of the change in this room. In addition to the technical differences noted, it should be stated that the reaction of the men in the composing room to the new lighting system has been very favorable. They are already more than enthusiastic about the change and there is a brisker atmosphere quite apparent. That the workers should be satisfied with the lighting is especially important on this floor as it is used twenty-four hours per day, and thus there is a great deal of work under the artificial illumination.

A REMARKABLE CHANGE IS NOTED IN THE PRESS ROOM ON THE TENTH FLOOR

On this same floor, section "C," there is the job press department of the company. A system of daylight illumination at the presses was desired in order to distinguish colored designs, in addition to the requirement of high intensity. Accordingly, six 18½-in. "RLM" standard-dome reflectors were installed over the presses, each equipped with 500-watt bowl-enameled daylight "Mazda C" lamps mounted close to the ceiling.



	1	2	3	4	5	6	7	8	9
Old reading	2	0.5			4.5	4	3.5	4.5	3.5
New reading	2	0.87	1.70	9.3	16.2	18.6	15.2	12.4	18.2

PHOTOMETER READINGS OF FIRST FLOOR, BINDERY DEPARTMENT; CEILING HEIGHT 18 FT.

Section A—"Holophane" mill type No. 651; 300-watt "Mazda C" lamps; watts per square foot, 1.50.
Section B—14½-in. "RLM" reflectors, ceiling type; 100-watt bowl-enameled "Mazda C" lamps.
Section C—18½-in. "RLM" reflectors, ceiling type; 300-watt bowl-enameled "Mazda C" lamps.
Section D—14½-in. "RLM" reflectors, ceiling type; 100-watt bowl-enameled "Mazda C" lamps.

Composing frames and the make-up "stone" in this room were equipped as in the main composing room in addition to the "Glassteel" units for general illumination.

TENTH FLOOR—PRESS ROOM

The entire tenth floor is occupied by two rows of printing presses, as shown on the accompanying diagram, each row located under two outside lines of outlets. The two center rows of outlets are for general illumination and for the center aisle, where there are supplies of paper, etc. Color work is done on many of these presses and daylight illumination is therefore essential. Accordingly 18½-in. "RLM" standard-dome reflectors were installed at a height of 12 ft. from the floor and equipped with daylight bowl-frosted "Mazda C" lamps. The two center rows are 300-watt, the others 500-watt. Again the illumination produced can be understood from the accompanying diagram, but, as before, the general effect in the room can be appreciated only by actual personal investigation.

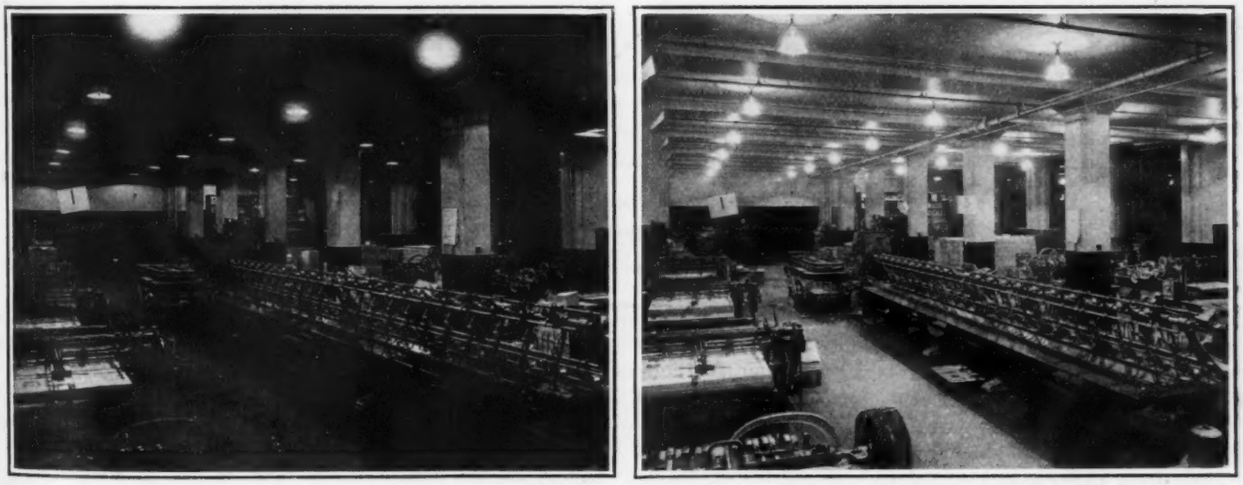
FIRST FLOOR—BINDERY

The bindery occupies the entire first floor. It is occupied by automatic binding machines and there is very little close vision required. An inspection of the accompanying diagram indicates the location of these and also of the outlets. The ceiling height is 18 ft. in this room, and it is advisable to keep luminaires well up toward the ceiling on account of the machinery and its handling. Ordinary distributing dome reflectors previously used did not give the proper distribution, and an entirely different sort of luminaire was sought. Accordingly "Holophane" prismatic-glass mill-type units, No. 541, equipped with 300-watt "Mazda C" lamps, were installed on this floor. This unit was judged to fit the industrial purpose here in mind most admirably, and the results show that it has afforded an even distribution of light over the entire working plane, increasing the intensity to about 14 foot-candles.

In addition to the large areas described, there are at least twelve other smaller rooms or parts of floors, each presenting some small illumination problem and each equipped on the same general basis of increasing the illumination intensity to modern levels, removing glare and obtaining maximum diffusion.

Although the engineers were told to proceed without reference to cost but with the idea of recommending the best system of illumination for each condition encountered, it was found when they had finished their recommendations that the total cost for the entire office and plant of the McGraw-Hill Company was below original expectations. By some it is thought that the present installation is but a step toward still higher intensities in the future. However that may be, the installation just made does afford one of the best examples of present-day illuminating engineering practice to meet a large number of requirements.

The McGraw-Hill Company is naturally very much indebted to the engineers of the lamp companies mentioned above for their co-operation in helping to make this installation an "industry job," representative of the best that there is in modern illuminating engineering practice.



THE BINDERY DEPARTMENT ON THE FIRST FLOOR HAS BEEN CHANGED FROM LOW SHADOWY ILLUMINATION TO WELL-DIFFUSED HIGH INTENSITY

Evaluation of Insulating Materials

Difficulty Encountered in the Formulation of Tables of Properties that Can Be Used for Comparisons—Uniform Testing Methods Now Being Used that Will Standardize Practice

By LAWRENCE E. BARRINGER
Engineer of Insulations General Electric Company

SINCE the many varied requirements of service cannot be fulfilled by a few insulating materials only, and a large number is consequently necessary, the matter of choice or selection of insulating materials has become extremely difficult. It often happens that the proper or best material is not chosen at the outset, as is revealed by subsequent service tests which indicate the necessity of better insulation.

The designing electrical engineer usually has not available sufficiently reliable data upon which to base his choice of material, particularly if he is buying it in the open market or selecting it from the field of commercial materials generally available. This is largely due to the great difficulty of formulating tables of properties which can safely be used either for comparison or for determining the form and amount of insulation to be used.

The selection of insulating materials has been largely based upon experience gained in cut-and-try methods, but in the past few years testing of a more general and uniform nature has been carried on with a view to establishing the specific properties of the materials most generally used.

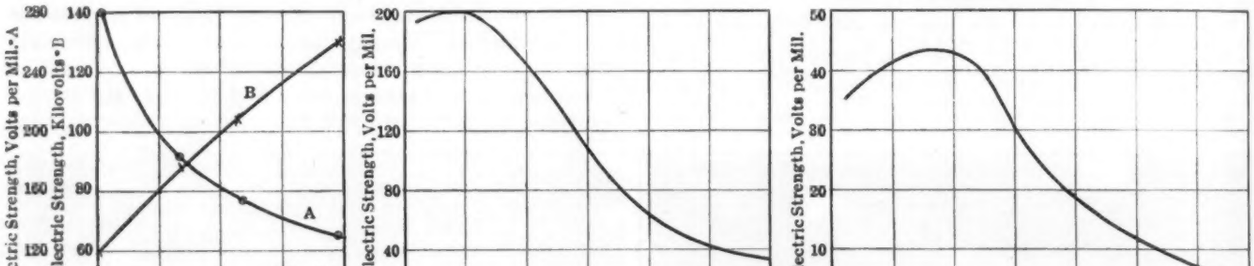
However, even the testing of the past few years has been conducted in a haphazard manner without regard to correlating the tests with those made upon similar materials by other investigators. Usually the engineer or builder of electrical equipment conducts tests improvised to determine the suitability or unsuitability of the material for his particular purpose, and the results are not ordinarily of value to those interested in other types of apparatus or fields of service.

In testing work insufficient consideration has been given to the effect of various conditions upon the resulting values. Temperature, humidity, thickness of specimen, time period of voltage application, frequency, pressure of electrodes and other conditions all have a marked effect upon the values obtained, and unless these conditions are reported with the results, the latter cannot be taken as strictly indicative of the true comparative value of the insulation.

The dielectric strength of standard wet-process porcelain of different thicknesses, all conditions except thickness being kept constant, is shown in Fig. 1. The dielectric strength of this porcelain may therefore be reported as low as 120 volts per mil or as high as 260 volts per mil, depending upon whether the specimen tested was approximately 1 in. thick or ¼ in. thick. The manufacturer would naturally like to report the higher figure, but in so doing might mislead the user intending to employ a bushing made of considerable thickness for mechanical reasons aside from insulation.

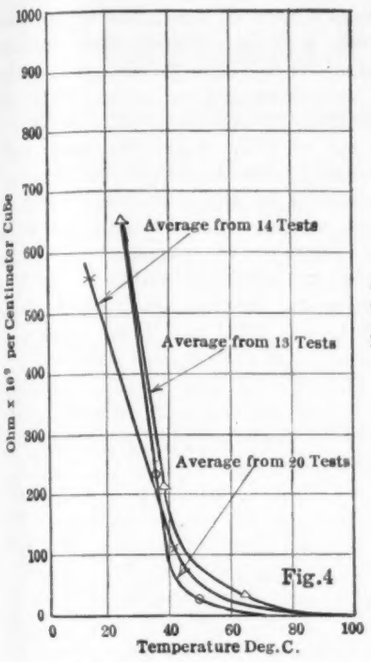
The decrease of dielectric strength of standard electrical wet-process porcelain with rise of temperature is shown in Fig. 2, and the effect of increasing temperature upon the dielectric strength of No. 31 compound—a refractory, porous, ceramic composition used for cylinders or spools in devices subjected to wide and abrupt temperature change—is shown in Fig. 3. This property of insulations is also generally well known, and yet but few tabulations of the dielectric strength of materials make reference to the temperature of test or even state whether all materials were tested at identical temperatures. Frequently designers have prepared tabulations for temperature correction of materials used in special apparatus, and in wire and cable work it is quite common to have tables prepared showing the relative insulation resistance of standard cable wrappings at various temperatures.

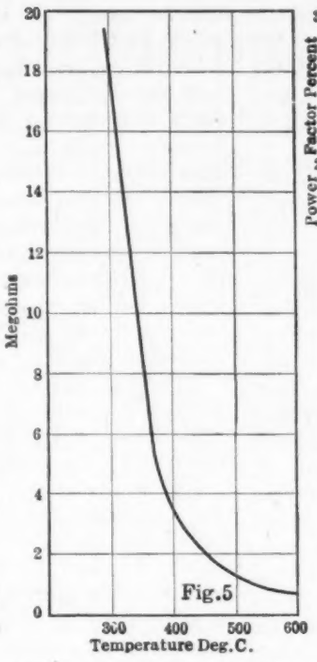
The decrease of insulation resistance as the temperature rises is particularly rapid in those materials where sustained values are most desirable, as in cloths and papers, both treated and untreated, as used for wire and cables, armature coil insulation, etc. This is shown

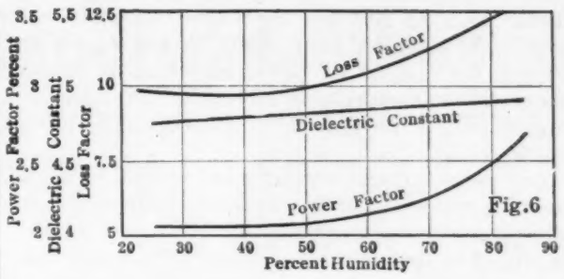


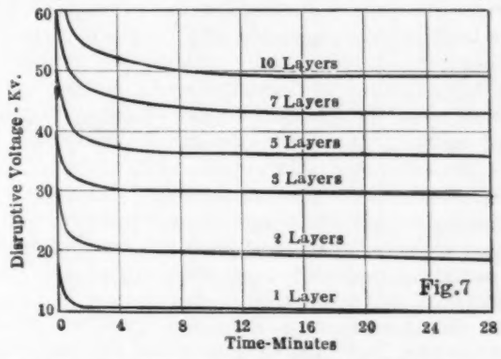
FIGS. 1 TO 3—DIELECTRIC-STRENGTH TESTS OF VARIOUS INSULATING MATERIALS

Fig. 1—Curves showing dielectric strength of wet-process porcelain at different thicknesses. The tests were made under oil at 25 deg. C., 60-cycle, using 1-in. spherical electrodes. Voltage raised at a rate of 1 kv. per second. Fig. 2—Dielectric strength of standard wet-process porcelain. Fig. 3—Decrease of dielectric strength of No. 31 compound with increase of temperature.









FIGS. 4 TO 7—RESISTANCE, POWER FACTOR, DIELECTRIC CONSTANT AND VOLTAGE PUNCTURE OF INSULATING MATERIALS

in Fig. 4, covering tests upon taped bars, using black varnished cloth tape in commercial use. Fig. 5 illustrates the same characteristic in wet-process electrical porcelain, a rapid decrease not taking place until comparatively high temperatures are reached.

The variation in values for power-factor and dielectric constant of Bakelite-paper panelboard used in radio apparatus, where such values are of importance, is shown in Fig. 6.

The importance of the control of humidity in testing porous materials, such as paper and cloth, has probably not been sufficiently realized until quite recently. It is true that most investigators have tested dried samples, but they have not always taken into consideration that such specimens, particularly paper, reabsorbs in a few seconds an amount of water almost equal to the quantity expelled. Often before the test can possibly be applied the percentage of moisture has increased in the specimen to such an extent that the drying has been rendered quite a useless and misleading step in the procedure. Conversely, paper transferred from a condition of high humidity to one of low humidity will within a very few minutes lose a substantial percentage of the contained moisture. Porous materials are so susceptible to these changes in relative humidity that only testing in a closed room, in which the humidity is controlled and kept uniformly at a certain point, will insure results strictly comparable as to definite values. If a relative humidity so affects the insulating values of porous materials, it is obvious that actual immersion in water must do so even to a greater extent, and for apparatus to be exposed to water, as railway motors, pumping machinery and certain marine devices, dry values alone cannot be accepted as indicative of the fitness of the insulation for the service.

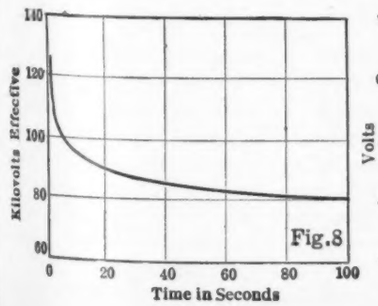
The effect of time of application of voltage upon puncture is illustrated in Fig. 7, where the material is black varnished cloth tested in various thicknesses (secured by multiple wrappings or tapings), and in Fig. 8, where the material is wet-process porcelain.

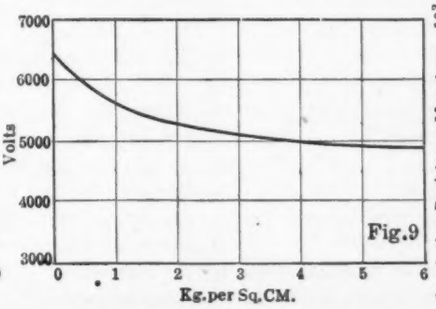
That pressure of testing electrodes has a pronounced effect upon the breakdown voltage of presspan is indicated in Kinzbrunner's curve (taken from the *Electrician*, 1905), shown in Fig. 9.

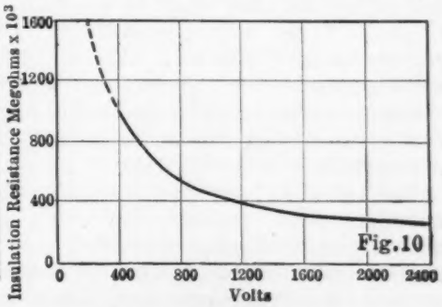
When testing for and reporting volume resistivity the voltage applied must always be considered, the effect of voltage upon the resistance of a dry-process porcelain tube being shown in Fig. 10.

Air as a dielectric is affected by the various conditions affecting other insulations and also more largely by difference in density than the solid and liquid materials. This variation in the insulating properties of air affects certain properties in insulators, particularly surface resistivity and arc-over voltages, and the results of tests for such properties should be accompanied by a statement as to relative humidity and air density (or altitude).

Recent tests upon a molded insulation with syn-







FIGS. 8 TO 10—CORRELATED TESTS OF INSULATING MATERIALS NECESSARY FOR COMPARISONS

thetic resin as the base or binder indicated a fall in transverse strength from 9,500 lb. per square inch at 20 deg. C. to 4,750 lb. per square inch at 100 deg. C., and a fall in compressive strength from 26,500 lb. per square inch at 20 deg. C. to 9,000 lb. per square inch at 100 deg. C.

Low temperatures render most flexible or plastic insulating materials brittle and less resistant to impact, some much more than others. Even soft rubber may be chilled so that it can be powdered in a ball mill.

It is obvious that many claims for insulating materials are quite valueless for the purpose of establishing a true relation between one or more materials. Furthermore, when definite values are claimed they are often so vague or unsupported by statements of testing conditions that the figures are of little use for purposes of calculation in the design of electrical apparatus.

The ultimate solution of this complex question, of course, is the standardization of methods for testing insulating materials, and for several years engineers of this company concerned with the production and use of insulating materials have been engaged in formulating standard tests, working in conjunction with committees of the American Society for Testing Materials, the American Institute of Electrical Engineers and other groups. The General Electric Company now has outlined more than eighty standard tests for the various types of insulating materials. These tests cover the insulating or electric properties and also the physical and chemical properties related to the performance of materials under assembly and service conditions.

With standard tests and standard specimens to be subjected to such tests, comparisons of insulations may be made much more reliably and test results may be much more safely utilized by electrical engineers.

Letters from Our Readers

Better Engineering Needed in Motorization

To the Editors of the ELECTRICAL WORLD:

I was much interested in a recent article decrying the lack of proper motor application in industrial plants, warning mill men against the indiscriminate purchase of motors and commending the large manufacturers or central-station experts for their motor-application engineering. I quite agree with the wail of the writer of the article referred to, and I agree also that motor-application engineering should be used rather than the hop-skip-and-jump, dollars-and-cents method of motor purchase usually employed.

I do not, however, agree with the suggestion of "expert" assistance as an antidote. My observation has been that this antidote is often worse than the disease. I am not opposed to experts or slide-rule education—as it happens, I am a "B.S." myself. Nor am I opposed to the very excellent superdevelopments of the large manufacturing and utilities companies. But this is what happens, under present conditions, on a motor-application proposition:

The technical graduate is swallowed up by a large manufacturing company, admittedly a good business policy; goes through a one-sided apprenticeship training, becomes eventually a motor salesman and at last reaches the ultimate customer. Or he may have drifted into the expert (?) department of a central-station company, or I should say a consolidated public utilities corporation, and again reaches the public as a motor solicitor or expert motor-application man. Now the inexorable law of human nature steps in. He has a living to make, has got married, etc. The sales manager cries: "More sales, more sales—or you lose your job!" Or that blackboard in the manager's office of the power department, calling for 100 per cent to be reached this month, bonuses, etc., harasses the young man. His engineering instincts are blown to the four winds, and he concludes that he has his living to make and that he is going to sell what the "dear customer" thinks he wants or what is easiest to put over.

There is another interesting angle. Very rightly, utility companies are emphasizing good power factor, but there is a "nigger in the wood pile"—and the bills received by the customer are it.

Again the power solicitor is called in to explain to the customer this extra power-factor charge. The power solicitor ties the customer up in a double bowknot. It ends in the suggestion that by putting in power-factor corrective apparatus manufactured by several companies, but particularly by one company, the customer can save that penalty charge. Later, the solicitor calls up a salesman friend and gives him the tip—all perfectly legitimate.

Then the manufacturer's salesman gets the customer further tied up—regrets the severe requirements of the power company, enlarges on the great saving, makes the sale of much more expensive power-factor corrective apparatus than would have been required if correct motor application had been originally installed. But why worry? Grist to the mill.

Still another angle presents itself. The "dear customer" desires a machine tool, motor-driven. Perhaps he elects to buy the motor or perhaps it comes with the tool. In either event the resale manufacturer is requested to specify the motor, which he does. Now, how has the resale manufacturer determined the motor size? Probably he has an excellent machine-tool draftsman, expert in gear drives, mechanical stresses and strains. It is probably up to him to specify the motor. He does it from a general thumb-rule experience—size of belt formerly used—or perhaps he is friendly with a motor manufacturer salesman who gives him expert (?) advice from his printed tables; perhaps he has had experience with 50-deg. motors and "plays safe."

The final result in 90 per cent of the cases is an excessively overmotorized machine tool, or a wrong type; which means poor efficiency and poor power factor. But what does the machine designer know about power factor? Nothing, and cares less. He "passes the buck"—"let George do it." Is all this conducive to increased motor using? I claim that everybody loses.

Lincoln said: "You can fool all of the people some of the time, and some of the people all of the time; but you can't fool all the people all of the time"—and, believe me, the motor user is getting educated, because all this reaches his pocketbook. What is needed in this motor-application matter is nine-tenths "horse sense," millwrighting, and one-tenth slide-rule engineering; no "bell-hop" wiring experts, and more "honest-to-God" commercial engineering in the real, unbiased interest of the customer.

ARTHUR H. ALLEN.

Philadelphia, Pa. (In the electrical business since 1887.)

Central Station and Industrial Practice

Reducing Cost of Pole Inspection

By C. B. Hefner
Superintendent of Distribution Dallas (Tex.) Power & Light Company

Although Southern pine holes can be completely impregnated if they are well seasoned beforehand, it is recognized that poles are not a manufactured product and consequently uniformity of quality cannot be expected. For this reason as well as the fact that all pole distributors do not make "quality" service their guiding policy, as a few do, the Dallas Power & Light Company inspects the penetration of poles before shipment. A man is not sent to the point of shipment to inspect every pole because the salary and traveling expenses of such a man would be out of keeping with the benefits derived. Instead, irregular inspections are made at the utility's instigation by a commercial laboratory at a cost of about 50 cents a pole. Poles are selected at random for inspection. If a few unsuitable poles are detected, the whole shipment is not canceled on the strength of this inspection. However, such an observation indicates that more thorough inspection should be made before acceptance.

The chief advantage of this irregular picked-at-random inspection is the reduced expense compared with regular and more thorough inspection. It has a further advantage in that it quickly indicates the distributors who can be depended upon for "quality" service regardless of checking. When poles have to be purchased of distributors who might have a tendency to be careless, the effect of spasmodic inspection without notification is to keep them and their men on guard against laxity.

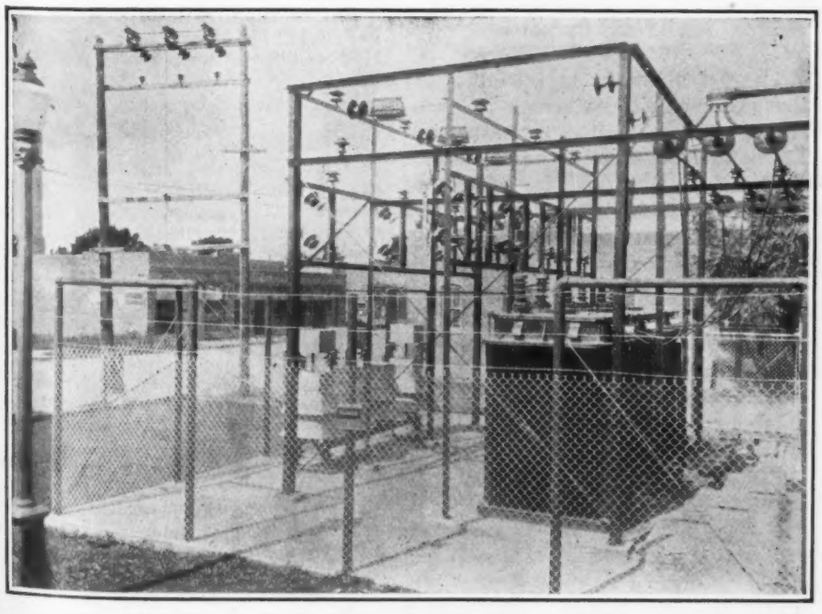
Inspection of impregnation is made with an increment bore. In addition to making an inspection before shipment, the company tests poles for deterioration (also with an increment bore) after they have passed about one-half their expected life. The test is made at more frequent intervals as the time of expected retirement approaches.

Compact 22-Kv. Substation Structure

By Thomas Hughes
Superintendent Sheridan County Electric Company

An outdoor substation which has recently been completed in the city of Sheridan, Wyo., by the Sheridan County Electric Company is shown in the accompanying illustration. The voltage of the incoming three-phase line is 22,000. At present there is a transformer capacity of 1,050 kva., with switches, choke coils, etc., large enough for 6,600 kva.

When building this structure it was so designed that it can be extended at any time in case another bank of transformers is needed. This can be done without altering the present structure. The steel work was purchased at a cost of $425, using 3-in. angle iron for cross-members and 6-in. I-beams for uprights. The substation was designed and constructed under the supervision of the writer.



SUBSTATION OF ANGLE IRON AND I-BEAM CONSTRUCTION HAS CAPACITY OF 1,050 KVA.

Economical Brass Melting in Electric Furnaces

With two 300-kw., 1-ton Detroit furnaces, the General Aluminum & Brass Company, Detroit, has, since 1920, been turning out one-half of its daily 50,000 lb. of red brass with an energy consumption averaging 280 kw.-hr. per ton. This company installed one unit during war time in 1918, and the second was added in 1920 because of good operating experience with the first. Considering the cost of operation, V. Skillman, chief metallurgist, has found from operating tests that the expense per ton of electrically melted brass varies between $13.90 and $15, considering all overhead charges. The red brass melted had a copper content of 85 per cent, lead 5 per cent, tin 5 per cent and zinc 5 per cent. An average of seven heats per nine-hour day with a temperature ranging from 1,900 deg. to 2,100 deg. F. is poured into molds for the bronze bearings and castings manufactured by the company. The electrode consumption varies between 3½ lb. and 4 lb. per ton.

A neutral lining is used by Mr. Skillman, manufacturer of corundite, which has melted on an average 2,000,000 lb. of brass per lining. At the present time one furnace is used for smelting 16,000 lb. of brass per day. Experience has shown that the life of a lining is solely dependent upon the good care of operation, a

steady rocking and a continuous patching of burned-through sections. There is also a further factor in preserving the life of a lining by not forcing a heat. When this is done, the increased temperatures shorten the life of the lining. Thus continuous operation and the production of a good quality of brass are direct functions of operating conditions.

Another factor in the superiority of the electric furnace is its ability to turn out a large production of brass of a uniform quality. By keeping check on the kilowatt input, the weight and quality of the mixture, there is less degree of risk in melting a non-uniform quality mixture. Then, too, the electric furnace has a lower melting loss, especially of the volatile zinc, which is a large factor in pit-fire work. Taken as a whole, this organization has found that it has saved money by installing electric furnaces for producing brass.

Approaching Storms Detected by Static Instrument

BY JOHN VAN VEEN
Chief Operator Union Gas & Electric Company, Cincinnati

DETECTING the presence of distant storms in order to have generators ready for instant load demands does not require so much expensive equipment as some operating engineers might suppose. The apparatus installed in the remote-control room of the West End generating plant of the Union Gas & Electric Company is very simple. The equipment consists of a panel on which is mounted an ordinary doorbell connected with a dry-cell battery, a Marconi coherer, two sensitive electromagnets, an electric lamp and a combination push-button switch and socket for an attachment plug, as shown in the wiring diagram (Fig. 1). Leading from the panel (Fig. 2) is an aërial and ground wire.

The aërial wire is a single strand antenna stretching 100 ft. overhead from the smokestack to a corner of the roof of the building. When the bell starts ringing and the light flashes it is an indication that a storm is in the distance. Since the storms take from one hour to two hours to reach Cincinnati, sufficient time is allowed the operators to prepare for increased load demands occasioned by darkness.

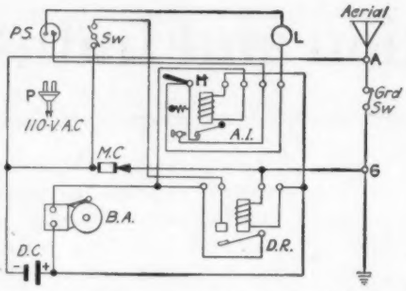


FIG. 1—COHERER OPERATES STORM DETECTOR BY MEANS OF STATIC DISCHARGES

A = Aërial terminal.
G = Ground terminal.
L = Indicating lamp.
H = Reset handle.
P = Plug.
P.S. = Plug socket.
D.R. = Detector relay.
Sw. = Push-button switch.
M.C. = Marconi coherer.
D.C. = Dry cell.
B.A. = Bell alarm.
A.I. = Auxiliary indicating relay.

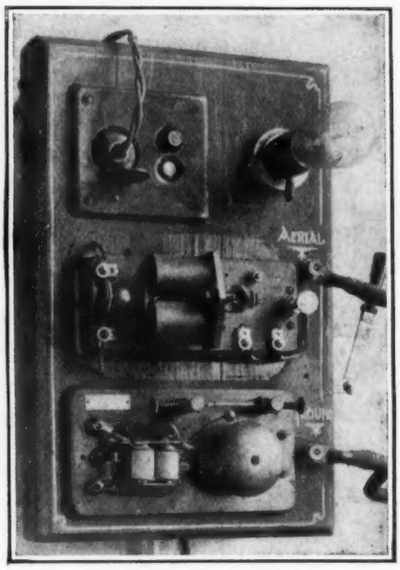


FIG. 2—PANEL MOUNTING OF EQUIPMENT FOR STATIC DETECTOR

The set operates on the principle that static electricity always precedes and accompanies an electrical storm. This static collects on the aërial and discharges through the Marconi coherer to ground, which decreases the resistance of the coherer and allows enough current to flow through the detector relay winding to cause its armature to pick up and close the bell-alarm (*BA*) and auxiliary indicating-relay (*AI*) circuits. The operation of the relay (*AI*) armature unlatches a lever which is pulled over by a spring and closes the indicating lamp circuit, causing the lamp to light. In order that the bell shall not ring continuously the Marconi coherer is arranged so that the bell clapper vibrates against it and separates the iron filings. This causes the ringing of the bell to be intermittent as long as the static discharge continues, and when the storm is past it automatically disconnects the bell circuit. The lamp circuit, however, must be disconnected by the handle *H*.

Megger Test of Substation Transformers

AS PART of the systematized instructions of the Worcester (Mass.) Electric Light Company covering transformer inspection, repair and testing, that section devoted to the insulation testing of windings should be particularly adaptable to other systems with minor local modifications. These instructions are given below:

The service engineer shall be responsible for the tri-monthly megger test of insulation resistance and inspection for visible trouble of all substation and power transformers fed from the 13,200-volt system, and also for a complete record of such tests and inspections that are made.

The combined megger test and inspection shall be made by the service engineer on the first Sunday of January, April, July and October, or as soon thereafter as practical, and shall be carried out in the manner described in the following paragraph:

After some suitable arrangement has been made to care for the load, both sides of the transformer shall be disconnected from the line. Two megger tests shall be made, one between the primary winding and the combined secondary winding and core, and one between the secondary winding and the combined primary winding and core, and if either of these tests shows a low resistance, a third test shall be made between the primary and secondary windings.

Before making these tests the megger shall be placed in a secure position and leveled up by means of the spirit level provided. The "line" terminal shall be connected to the coil under test, and the "earth" terminal shall be connected to the coil not under test and shall also be connected to the case of the transformer. The "guard" terminal is not used. When the connections are complete, the megger crank shall be turned at about 100 r.p.m. until the pointer shows a constant reading for at least five seconds. The resistance in megohms shall be recorded, and if the coil shows a low resistance, a third test shall be made between the primary and secondary coils. A general inspection of leads and bushings shall be made and any visible defects noted.

Unless some serious defects are found, the transformer shall be restored to service, and the result of the inspection and megger tests shall be given by the service engineer to the secretary, who shall record them on the corresponding "Substation Transformer Record" in the general superintendent's office.

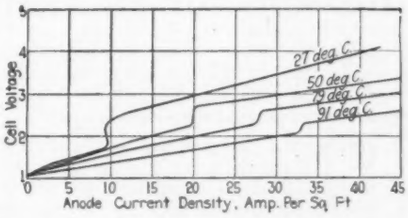
Producing Electrolytic Iron Commercially

HOPEFUL investigations in the field of electrolytic iron production were outlined at a recent meeting of the Boston Section, American Institute of Mining and Metallurgical Engineers, by F. A. Eustis, consulting engineer, New York and Boston. At present a French company, the Société le Fer, which was a pioneer in making commercial quantities of electrolytic iron, is producing about 1.5 tons of iron tubes per day. While occasional trouble is experienced, the product is remarkably uniform and high-grade and is regularly sold at 10 francs a kilogram, or about 24 cents per pound at the current rate of exchange. Comparatively little attention is now paid to the speed of cathode rotation, but a motor is still used on each mandrel. At the Grenoble plant of the above company there are considerable losses of heat by radiation and evaporation, with voltage losses in the connections. Much of the product goes into containers for holding acetylene. The crop ends of the tubes are sold for reworking largely on their chemical analysis. This very pure iron is useful in making special alloys and for electric welding.

Status of Electrolytic Iron in the United States

In the United States two plants are now producing electrolytic iron commercially. The oldest, that of the Western Electric Company at Hawthorne, Ill., turns out about 2 tons per day, most of which is used in telephone loading coils. Recently small quantities have been quoted at the following rates per 100 lb.: Cathode sheets, $38; coarsely ground iron, $40; eight-mesh, $45. The Westinghouse company is also operating a small plant at East Pittsburgh for special electrical work in this connection.

Arrangements are now in progress by Messrs. Perrin and Eustis for the construction of a much larger electrolytic iron plant in this country, probably at Niagara Falls. The main production will be by the French process, which is the only one sufficiently proved to make possible the raising of the money needed. It is planned, however, to install a small Eustis process plant beside the new plant, to show the relative advantage of the two methods. The latter process starts from iron sulphide, which may be in the form of raw ore or concentrates. The sulphides are leached and electrolytic iron is produced directly from the solution. At the plant of the Milford (Conn.), Electrolytic Iron Company deposits of satisfactory chemical analysis have been attained, viz., sulphur, 0.001 to 0.006, and carbon, 0.02 to 0.06; but the French certainty of tube smoothness has not as yet been realized. There is need of perfecting the apparatus and of more experience in continuous operation. The hot ferric chloride obtained from the anode compartment is highly corrosive, but both white and blue asbestos stand up well in it, as does bakelite. Ebony asbestos wood, as made by the Johns-Manville Company, is useful; rubber lasts well and



CRITICAL ANODE CURRENT DENSITY FOR ELECTROLYTIC IRON PRODUCTION

good earthenware and glass are unattacked.

In the Eustis process the reaction at the cathode is essentially the same as in the French process. The reaction at the anode is the oxidation of $FeCl_2$ solution to $FeCl_3$. The current density at the anode is the important factor. The anode potential is about 0.7 volt for the oxidation of $FeCl_2$ to $FeCl_3$ and about 1.3 volts for splitting up $FeCl_3$ to liberate chlorine gas. The accompanying diagram shows the critical current density at the anode for different temperatures; i. e., the current densities at which the breaks in the curves occur (the breaks or humps indicate where the liberation of chlorine gas begins). It would seem that important savings in heat losses can be made in the future.

In the Eustis process the total amount of heat available to make up losses from radiation and evaporation is roughly 730 B.t.u. per pound of iron from solution reactions and 2,310 B.t.u. per pound from energy dissipated in the cells, a total of 3,040 B.t.u. These figures assume a current density of about 25 amp. per square foot. At 100 amp. per square foot the liberated heat would be about twice as great.

Under very favorable conditions a leach starting with 72 grams of ferric iron per liter has been completed in one hour, but normally about four hours should be allowed. A considerable number of impurities have been found harmless when present to the extent of a few tenths of a gram per liter. In this manner the following materials were classed as harmless: Aluminum, arsenic, bismuth, cadmium, cobalt, copper, mercury, nickel, tellurium, tin and titanium. Antimony appears harmful if present to the extent of 50 milligrams per liter, but can easily be kept below this concentration. Selenium and silver are apparently injurious at 1 milligram per liter. Lead caused no trouble with the deposit, but appeared in it.

The Making of Pure Iron

When making pure iron for melting or working into other shapes, smooth deposits are not essential. For such work plate cells will probably be used in which both electrodes are stationary. A typical cell design provides 400 sq.ft. of anode area and is to use 15,000 amp. The corrosive anolite is confined to asbestos bags surrounding the anodes and to very restricted passages from these bags. The bags are protected by grids, and each cell of this type should produce about 500 lb. of iron per day. A complete plant with a capacity of 100 tons of iron per day should not be more than 200 ft. square and two stories high.

The amount of power needed to produce a ton of iron in the Eustis process will vary with the voltage, which varies with the current density used. Assuming 2.5 tons iron per kilowatt-year, a conservative figure, there are many places where the cost of energy should not exceed $8 per ton. In extremely favorable places, such as Norway, power can be had for not over half this cost. The capital charges are not yet well settled, but may be of the order of $8 to $12 a ton.

There seems a fair opportunity that in the future this process can produce iron to compete in cost with present methods. The process has many other applications than the production of pure iron, notably in recovering iron and sulphur in copper, gold and silver mining, especially in mines far from smelters with electric power at hand. This may work out to be the first important use of this process. The development of cheap power for large-scale use to no small extent awaits a market of this sort.

Central Station Business

Cleveland Company Shows Unusual Industrial Film

A MOTION picture entitled "The Heart of Cleveland" has been produced by the Cleveland Electric Illuminating Company, which has been successful in showing it before schools, civic organizations, clubs, lodges, churches and other groups. It is neither an educational nor an industrial picture, but is the culmination of a new idea in presenting informational subjects entertainingly on the screen.

The film has an engrossing story, built around a country boy whose teacher has asked him to write an essay in a prize contest being conducted in the schools. The subject is "Electricity, What Does It Mean to You?"—and the youngster's problem is difficult because electricity doesn't mean a thing on the farm where he lives with his father and mother and sister.

His predicament seems hopeless, when an aviator descends on the farm at night. He is shown every hospitality by the farmer's family and the boy tells about his essay and asks his help. The flier finally agrees to take both children to Cleveland the next day, where he will show them what electricity really means.

From this point forward the children's adventures make an admirable medium through which to show many electrical operations in Cleveland's outstanding industries — the harbor, the iron and steel business, the clothing business, the automobile business, the manufacture of bricks, the making of incandescent lamps and the printing of newspapers. Incidentally, human-interest phases of utility operating and construction work are brought in with views of some of the plants.

To show the picture takes about thirty-five minutes, and very appreciative and complimentary comments from the public have been received by the Cleveland Electric Illuminating Company.

The cost of producing this film was approximately $16,000 and at its first showing was viewed by some 40,000 moving-picture patrons. The Cleveland company expects ultimately to exhibit the film to at least one million people who live in and about the city.

Reasons for Municipal Ownership Failure

By Bernard J. Mullaney
Vice-President People's Gas Light & Coke Company,
Former Commissioner of Public Works of the City of Chicago

CENTRAL-STATION men, firm in their belief in the economic soundness of their industry, are all too prone to pass over lightly the ever-recurring attacks by political demagogues upon the present system of private ownership of public utilities. Only by keeping before their customers and the public facts and figures which prove the practical failure of government or municipal ownership can the privately owned utilities expect successfully to combat this form of propaganda. The fifteen reasons for municipal ownership failure which Mr. Mullaney has here drawn up constitute an indictment of this popular political pastime which might well be placed in the hands of every customer of every central-station company in the United States.

1. Public utility service as a whole —electric light and power, transportation (both steam and electric), communication (telephone, telegraph and radio) and gas service—is more highly developed in the United States than anywhere else on earth, largely because it has been so little under the dead hand of municipal ownership. There is in the United States more utility service of better quality than anywhere else, and it is accessible to and usable by a greater proportion of the population at lower average rates than anywhere else.

2. Municipal (government) ownership has failed in the United States wherever it has been tried long enough to permit its inherent seeds of failure to sprout and grow. Wherever it has seemed momentarily to be succeeding, with its rates no lower and frequently higher than prviate company rates for comparable service, finances have been pieced out with tax money or the enterprise has been arbitrarily aided by methods closely akin to governmental tyranny.

3. Government ownership offers nothing but change of management. Governmental regulation has now all the power there is for fixing standards of service, for fixing rates, for controlling in the public interest the practices and acts of utility companies. Government ownership cannot confer additional benefits upon users of utility

VIEWS FROM MOTION PICTURE SHOWING THE IMMENSE COAL STORAGE AT THE CLEVELAND COMPANY'S PLANT AND ALSO THE TAKING OF THE FILM IN AN INDUSTRIAL PLANT WHERE AN ELECTRIC FURNACE IS IN OPERATION

service unless it sells service below cost and takes the difference out of the public treasury.

4. Government ownership cannot escape the exigencies and consequences —the vagaries and expediencies and necessities—of practical politics under our, or any, democratic form of government. Elections determine who shall run public enterprises and how. Campaign cries and plans and proposals and policies are focused on election day results, even at the sacrifice of sound business conditions. Under the most rigid civil service laws yet developed or sincerely enforced, the public payroll is still a political asset; economy and efficiency are not yet paramount.

DEVELOPMENT WOULD BE PARALYZED

5. Government ownership lacks the continuity in planning and building for the future—five, ten, fifteen years ahead—which successful public utility operation requires. If a new administration comes in, one of its first acts is to scrap the plans of its predecessor and so break continuity.

6. Government ownership does not function in merchandising its product or service as private management does —and must—to get the diversity of use and the volume of sales that make for efficiency, economy and lower rates. This is a fact usually overlooked. The United States Shipping Board found that ships do not make a merchant marine; cargoes are essential and they must be got.

7. Government ownership injects political uncertainty into plant extension financing, and extension financing is important. Plant and service facilities have to be increased as demand for service increases. Bond issues to pay for them or other financial measures have to be approved by popular vote and are subject to defeat by political circumstances having little or no bearing upon the financial proposals.

VAST PAYROLL BRIGADE

8. Government ownership tends to build an oligarchy of government employees, with the public interest in the payroll. The capable man can get a job far more easily from private management than from government management. "What can you do?" is the only question put by the former; the latter asks, "Who sent you?"

9. Government ownership cannot escape the restrictions imposed by law—and rightly so—upon the transaction of public business, which are loosely characterized as "red tape" and which inescapably hamper efficiency and economy in operation.

10. Government management tends always to become bureaucratic and, therefore, uneconomical, inefficient and unprogressive. Such simple but fundamental private business practices as budget making and cost accounting have come slowly, when at all, in the government.

11. Government ownership spells stagnation. It does not furnish the incentives to individual ambition, initiative, enterprise and inventiveness that inspire men to make the best of their brains and opportunities. The privately managed public utilities illustrate the converse of this. Their marvelous development in the United States has been due largely to inventions and improvements and applications of principles worked out by the men employed in them.

12. Government ownership can be judged fairly, not by what its theoretical proponents say it will do but by what it has done. Its results were editorially summed up in the Chicago *Tribune* of June 8, 1924, as follows: "There is no government office anywhere which may be set up as an example to private industry; hardly one that has been operated for a number of years which is not broken down, using obsolete and inefficient machinery and manned by an unduly large number of underpaid employees whose lot compares unfavorably with the condition of men and women in private employ."

13. Government ownership proposals are frequently and usually predicated upon one or another dishonest alternative; namely, (1) the taking of private property for public use without adequate compensation to the owners, as when existing public utilities are acquired by the municipality; or (2) the setting up of a government-owned business and employment of government power and advantage to promote it in unfair competition with private business enterprise already established in good faith and so entitled to governmental protection.

PRIVATE INITIATIVE

14. Government ownership inherently holds, in common with all intrenched "constituted authority," a tendency toward tyranny and repression. The initiative toward each milestone in the progress of the human race has come always, not from within, but from outside government authority.

15. Government ownership of public utilities is hostile to the very spirit of the United States and its institutions. It is foreign to the normal, every-day habits of thought and action among a prosperous, progressive, enterprising public. Government ownership is the masked advance agent of communism —not merely "socialization of basic industries for the common good," as the "pinks" have it, but the communism of the "reds" as the dictionary has it —"abolition of all private property and state control of all labor, religion, social relations, etc."

Better Lighting Appeal to Merchants

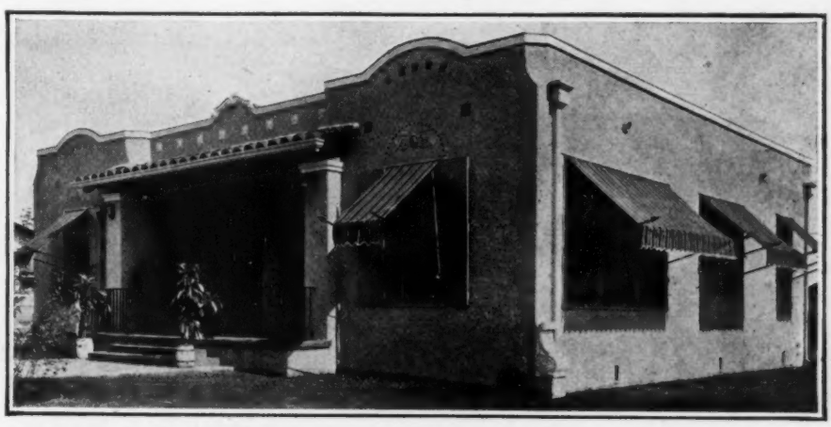
TO INCREASE the use of energy by merchants and storekeepers of the territory served, as well as to aid the local contractors and dealers affiliated with the company, the Western New York Electric Company, Jamestown, N. Y., which supplies the surrounding area with Niagara power, has inaugurated a series of newspaper advertisements, one of which appears here. The advertisements are run semi-weekly in the local newspaper and changed each week. Each advertisement emphasizes the importance of proper lighting through the scientific installation of equipment.

Use Niagara Power
MR. MERCHANT:
Have you noticed the lighting of our new offices?
Information cheerfully rendered by our Commercial Department and aids by load management.
Is Your Service Good? If Not Please Let Us Know
Western New York Electric Co.
Fourth and Pine Streets Jamestown, N.Y. Phone 141

STIMULATING COMMERCIAL LIGHTING

Utility Sets Example in Electrical Homes

THE West Texas Utilities Company is a firm believer in the virtues of attractive buildings and well-kept parks and grounds as a stimulus to civic progress and better



HOME OF CENTRAL-STATION SUPERINTENDENT EXHIBITED AS MODEL DWELLING

business. Whether it is a general office building or a tool shed that is to be constructed, this company insists that its exterior present a pleasing appearance. In virtually every one of the thirty-four towns and cities it serves will be found visible proof of this settled policy.

The latest architectural effort of the company is an electric home, now being shown to the public at Cisco, Tex. It has been constructed as representing the ideal home of the average family. Like the "electric home beautiful" built by the company last year in Abilene, the one at Cisco is of Spanish architecture. P. W. Campbell, superintendent for the company of the Cisco district, will occupy the house after the public has inspected it.

The residence has been completely equipped electrically with particular attention to adequate wiring and lighting. Complete with furnishings it cost approximately $8,000 and was designed to show that it is possible to build a modern home equipped with all electrical conveniences at a comparatively low cost.

Improved Store Lighting Encouraged by Exhibit

THE Merchants Heat & Light Company of Indianapolis is making an energetic campaign among the merchants of that city for better lighting. At a recent industrial show staged by the Indianapolis Chamber of Commerce the company occupied a display space equal to several booths where it demonstrated different applications of lighting. The accompanying view shows how various-size lamps were displayed and the evolution of illumination depicted in models. A series of cabinets shown at the rear was used to bring out the effect of varying candlepower and location of the light source. Officials of the company were well pleased with the results of the display, as there has been a noticeable increase in the inquiries from business men as to ways by which they could improve the lighting of their stores.

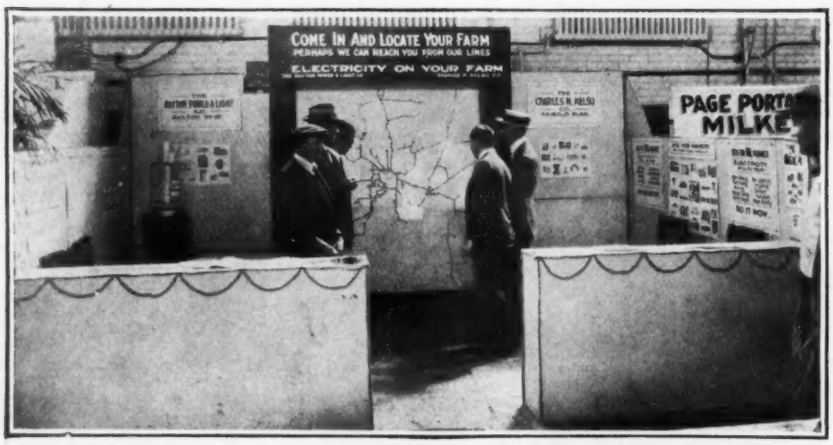
Utilizing County Fair to Develop Rural Service

BY M. H. WAGNER
Manager Electrical Department,
Charles M. Kelso Company

THE Dayton Power & Light Company and the Charles M. Kelso Company (constructor of lines), both vitally interested in placing electricity on the farm, joined forces in an exhibit at the Montgomery County Fair, Dayton, Ohio, early in September, with very gratifying results. First of all, a convenient and comfortable lounging place was provided for farmers who might stroll past the exhibit, the chief feature of which was an electrically illuminated highway map showing the Dayton company's distribution lines. Each district of the Dayton Power & Light Company's territory was lighted in turn, and finally the complete map was illuminated. Thus lighted with different colored lamps, which were periodically turned off and on, the exhibit immediately attracted attention. As the highways were clearly indicated, the farmers who stopped to look at the map usually drew near for closer observation, particularly to indicate to some companion the location of their respective farms. This afforded the booth attendant the opportunity of ascertaining whether that particular farm was or could be served advantageously from the central-station company's distribution circuit and quickly brought forth a discussion of electric service on the farm.

It was rather remarkable what a large number of the farmers had previously discussed this possibility with their neighbors, but at no time had they approached the central-station company for such service. This booth afforded them such an opportunity, as the results at the end of the fair indicated. During this exhibit there were approximately forty-nine groups of farmers who directly applied for proposals covering rural-service extensions, and the total number of farms that were represented by them was about 450.

The exhibit had another advantage. It seemed to attract the existing consumers, who in many cases discussed with the booth attendant their particular problems, however small, and in this way created a spirit of co-operation between the consumer and the power company. In general, the exhibit broke down the barriers which some existing consumers and prospective customers feel exist between them and the utility company and created such a desirable "get-together" effect that the exhibit will probably become a permanent institution.



ILLUMINATED MAP SHOWING RURAL LINES EXHIBITED AT COUNTY FAIR

Digest of Electrical Literature

Hydro-Electric Development and Steam Equipment

Hydro-Electric Power Development at Ruth Falls.—L. B. McCURDY.—Ruth Falls is situated two miles above tidewater on the East River Sheet Harbor in Nova Scotia, and the development under way will supply power to the Albany Perforated Wrapping Paper Company, which is now constructing a ground-wood-pulp mill. A preliminary sketch is given of the power development, in which at present two 3,000-hp. vertical turbines, directly connected to 2,500-kva. generators, will be installed. The ultimate installation will call for three units of 3,000 hp. under a gross mean head of 109 ft. and a net mean head of 107 ft. The initial development is being designed to utilize 365 sec.-ft. continuous flow. — *Canadian Engineer*, Sept. 30, 1924.

Fifteen Years' Progress in Water-Power Development at Holtwood.—An illustrated description of developments leading to the existing installation of ten units having a total capacity of 158,000 hp. on the lower Susquehanna, a stream subject to extreme fluctuations. During the period of growth the rating of the units has been increased about 25 per cent and the efficiency raised from 83 per cent to about 92 per cent. To put in the new turbines it was necessary to remove and rebuild the sub-structure. Data are given for the plant as a whole and for the individual machines.—*Power*, Sept. 30, 1924.

Boilers, Superheaters and Economizers.—This is the serial report of the sub-committee on this subject of the prime movers committee of the N. E. L. A. It presents the principal features of many boiler installations made during the past year in old as well as new stations. Attention is called to the brief statement of operating results of the boilers at the Hell Gate station of the United Electric Light & Power Company in New York. As in the 1923 report, additional information is given, showing the variations in flue-gas temperatures, superheat and boiler efficiencies in a boiler fired with oil, these variations being due to the variation in the CO_2 content of the flue gases. In view of the adoption of the Yarrow marine-type boiler for stationary practice in a large station in England, a brief description of this boiler has been included. Another item of foreign development included is the combined boiler, superheater, economizer and air heater manufactured by a Swedish concern. Some very interesting data were secured on the operation of one of the economizers and a radiant heat type of superheater, installed in the bridge wall of one of the pulverized-fuel boilers at the Lakeside station of the Milwaukee Electric Railway & Light Company. These showed a uniformity of steam temperature obtained by blowing the soot from the different portions of the superheater in regular order.—*Publication No. 24-74 of the N. E. L. A.*

Generation, Control, Switching and Protection

Economical Loading of Turbo-Generator Units.—M. K. DREWRY.—A detailed study of load division is warranted because of the fact that the turbine water-rate curve is not a flat one; it has a marked minimum point from which departures in load rapidly cause considerable throttling losses. Under certain conditions the shifting of a few thousand kilowatts from one machine to another may entail a loss or accomplish a gain amounting to several per cent. Installation of a load-limiting device to maintain the large and most economical machines of a power station at their most economical load may cause a twofold gain in economy and a saving in operating attendance.—*Power Plant Engineering*, Sept. 1, 1924.

Polyphase Induction Regulators.—L. H. A. CARR.—For alternating-current working it is possible to employ three types of boosters. The first is the synchronous booster, consisting of a synchronous motor driving an alternator, the armature of which is connected in series with the line. The second type of booster is the series boosting transformer, in which adjustable tappings are provided to vary the boost. The third type is the induction regulator, which gives a gradual increase or decreasing voltage. The latter type is the one that is most used in present-day practice. The author describes the various types and also the control apparatus necessary for each.—*Electrical Review* (*England*), Oct. 10, 1924.

Large Steam-Turbine Generators.—W. J. FOSTER, E. H. FREIBURGHOUSE and M. A. SAVAGE.—A general discussion of the developments that have made the extremely large generator possible, and of the direction of possible future improvements, leads into an illustrated description of 62,500-kva., 80 per cent power factor, 1,200-r.p.m., self-ventilated units recently built. Curves based on measured losses show 97.1 per cent efficiency at rated load and power factor and 97.8 per cent when the power factor is unity, with a temperature rise in the armature winding of 50 deg., by resistance temperature detectors, and 57 deg. in the rotor winding, by resistance measurement.—*Journal of the A. I. E. E.*, October, 1924.

Transmission, Substations and Distribution

Thermal Resistance Formula of Three-Core Sector-Shaped Cables.—K. SHIMIZU.—The approximate expression for calculating the thermal resistance of three-core sector-shaped cables (with equal thickness of dielectric between conductor and sheath) is found theoretically and compared with the experimental and graphical values. The thermal resistance R may be calculated approximately from the formula:

$$R = 0.087\ \rho \log_e(1.17t/r_0 + 1),$$

where ρ is the thermal resistivity, t the thickness of dielectric between conductors or between any conductor and sheath and r_0 the radius of a circular conductor of equal sectional area with the sector conductor.—*Journal of Institute of Electrical Engineers of Japan*, No. 431.

Power Transmission Lines.—W. P. TAYLOR.—This is Part IV of a series of articles on the determination of the various factors which affect the economical characteristics of the transmission line itself. This section takes up the subject of the new regulations issued by the Electricity Commissioners and the mechanical design of overhead power lines and gives several charts based on 8.0 lb. wind pressure plus ½ in. radial ice coating on the conductors.—*Electrical Review* (*England*), Sept. 26, Oct. 3 and 10, 1924.

The Corona as Lightning Arrester.—J. B. WHITEHEAD.—Experiments are described indicating a relatively simple and inexpensive method of equipping a transmission line to take advantage of the protective properties of the corona by suitable forms of discharge points. The charts presented show that the voltage at which corona begins, as well as the increase with rising voltage, can be controlled quite closely. It should, therefore, be possible so to design the equipment that discharge will begin when the working potential is exceeded by a predetermined amount and that above this point the relief will be rapid.—*Journal of the A. I. E. E.*, October, 1924.

Units, Measurements and Instruments

Selenium-Cell Density Meter.—F. C. TOY and S. O. RAWLING.—Two beams of light from opposite sides of an electric lamp, after being diffused by opal screens, pass through suitable optical systems and a specially designed shutter which enable them to fall alternately in quick succession on a selenium cell connected in series with a galvanometer and a source of electromotive force. The density to be measured is placed in the path of one beam and a standard optical wedge, which can be moved along a scale graduated in density units, in the path of the other. The wedge is adjusted until the deflection of the galvanometer remains constant. The intensities of the beams falling on the cell are then equal, and the value of the density may be read on the wedge scale. The instrument is essentially a density comparator and is calibrated by means of standard densities.—*Journal of Scientific Instruments* (*England*), September, 1924.

Variation of Residual Charge and the Ratio of Electrical Conductivity to Capacity Due to Temperature.—H. SAEGUSA.—The variation of residual charge and the ratio of conductivity to capacity for some crystalline dielectrics and some amorphous dielectrics were investigated experimentally by using a specially designed apparatus.

The results of these tests are enumerated.—*Journal of the Institute of Electrical Engineers of Japan*, No. 432.

Theory of Determination of Ultra-Radio Frequencies by Standing Waves on Wires.—A HUND.—This paper furnishes the theoretical background for the method of frequency standardization employing short standing waves on parallel wires. The discussion shows that correct results can be obtained by the Bureau of Standards method if the correction derived in the paper is employed in the calculation of the frequency. It is shown that the adjustment is based on a condition of resonance and, therefore, the settings are sharp and it is practical to approach the theoretical accuracy in actual operation for frequency standardization.—*Scientific Paper No. 491 of the Bureau of Standards.*

Motors and Control

Features of Ventilating Fans at 164 Coal and Metal Mines.—D. HARRINGTON and M. W. VON BERNEWITZ.—In studying the mine disaster files of the Bureau of Mines for preparation of a bulletin on coal-mine explosions, statistics have been compiled covering various features of fan installations and the handling of air currents at the time and after the disasters. These statistics and related matter are given in this pamphlet, which discusses the driving and reversing features of fans, value of reversibility of air currents and value of reserve vans, including general observations on fan installations, a contrast between coal and metal-mine ventilating systems contrasted and suggestions of what to do at the fan in case of disaster.—*Serial No. 2,637 of the Bureau of Mines.*

Parallel Concatenation of Induction Motors.—T. ISONO.—Concatenation of induction motors may be classified into two systems, series concatenation and parallel concatenation, according to their electrical connections. After describing the series concatenation of many induction motors, the author explains the characteristics of parallel concatenation with equations and circle diagrams. In the practical application of motors a synchronous speed corresponding to an odd number of poles which cannot be obtained by any ordinary synchronous motor may often be required and easily obtained by the parallel concatenation of two induction motors.—*Journal of the Institution of Electrical Engineers of Japan*, No. 431.

Heat Applications and Material Handling

Electric Smelting of Iron Ore in Norway.—C. WAHLUND.—The first paper represents a continuation of the previous discussions on the same subject by Batt and Tysland. It gives a general review of the present situation of this industry in Norway. The following paper gives the contributions by various Norwegian experts to the discussion of the above paper. [The papers by Batt and Tysland appeared in the same periodical of Feb. 15 and Aug. 23 and 30, 1924.] *Teknisk Ukeblad (Norway)*, Sept. 9 and 12, 1924.

Requirements for Various Kinds of Resistance Welding.—Engineering data are given on the electrical energy, time and mechanical pressure required for various kinds of resistance welding. There are so many variables entering into every weld, so many different materials to be welded and such a wide variety of applications of the welded product that generalities are practically useless, and each case should be treated to suit its particular requirements. The author outlines seven variables that enter into every weld, each of which may be subdivided. Two tables are given, the first of which shows the amperage, voltage, kva. input, kw. input, time and pressure readings for various sizes of stock for spot and mash welds. The second table gives values actually used in butt-welding various sizes of steel and copper.—*Journal of the American Welding Society*, September, 1924.

Electrophysics, Electrochemistry and Batteries

Effect of Flash and Fire Point on Transformer Oils.—H. C. P. WEBER and R. H. WYNNE.—In order to determine what regularities, if any, existed in the effect of halogenated hydrocarbons upon combustible oils, a study was made of the change in flash and fire points produced by varying percentages of a series of compounds. The oils were two transformer oils designated, respectively, "Lectroseal" and "Hi Flash" oils.—*Paper presented before the American Electrochemical Society*, Detroit, Oct. 2-4, 1924.

Radiation from the Quartz-Mercury Arc During the Period After First Striking.—B. D. H. WATTERS.—During a series of observations on the time taken by a mercury arc to reach a steady state certain variations of output were noticed in the first few minutes. An analysis of these variations was made and is described.—*Philosophical Magazine (London)*, September, 1924.

Traction

Operation of European Railways.—This issue is given over to the report of the American Electric Railway Association committee on foreign operations. The report covers transportation in England, Scotland, France and Switzerland. Some of the specific articles are "Observations on Foreign Practice," "London's Complicated Transportation Situation," "Paris Transportation Facilities," "Track Construction," "Overhead Construction," "Tramcar Design as Dealt With in Europe," "Rapid Transit Rolling Stock" and "European Motor Bus Design."—*Electric Railway Journal*, Sept. 20, 1924.

Electric Locomotives for the Detroit and Ironton Railroad. — F. ALLISON, H. L. MAHER and L. J. HIBBARD.—The Detroit & Ironton Railroad is to have a trolley voltage of 22,000, 25 cycles, alternating current, twice that previously used in this country. The locomotive will develop a maximum of 5,000 hp. at 17 miles per hour and will exert a maximum starting tractive force of 225,000 lb. on the basis of a 42,500-lb. axle loading with 33⅓ per cent adhesion. The nominal rating of the locomotive will be 4,200 hp. Each motive unit will be arranged for double-end operation so that an operating locomotive may consist of one, two or more units as desired. Each unit will weigh 170 tons. The trolley voltage will be stepped down in a transformer to 1,250, this in turn energizing a motor-generator set which will furnish 600 volts direct current to the driving motors.—*Railway Age*, Oct. 18, 1924.

Telegraphy, Telephony, Radio and Signals

Commercial and Government Radio Stations of the United States.—This publication contains a complete list of the commercial and government land and ship stations, technical and training stations, experimental stations and special amateur stations of the United States.—*Publication of the Bureau of Navigation, Washington, D. C.*

Communication Through Channels by Radio Relays.—E. YOKOYAMA, N. NARUMO, and J. TOKI.—Detailed descriptions of experimental research on telegraph and telephone communication systems through channels by radio relays which has been recently carried out through the Electrotechnical Laboratory of Japan are given. Two-way radio telephone systems, wire and wireless telephone systems and carrier-wave telegraph and telephone systems over overhead telegraph and telephone lines and power transmission lines are covered. A comparison is made between radio telephones and submarine telephones, from which it is concluded that the former are more economical than the latter at a distance of more than 15 km. when one channel alone is used. In the case of a number of channels the submarine telephone gives the best results. Detailed descriptions are given of valve transmitters and receivers, wire and wireless telephone apparatus, directive aërials and signaling devices.—*Journal of the Institute of Electrical Engineering of Japan*, No. 430.

Miscellaneous

Lubrication.—During the past year concurrent tests of lubricating oils have been made in the field and laboratory. These tests have brought out very conclusively the fact that with the oils tested heat and air were responsible for the oxidation and acidification of the oil, while the presence of water was responsible for the precipitation of sludge and the formation of emulsion. The data on various oils, so far as their life performance is concerned, are compared with laboratory tests of the same oils when new, in order to indicate the laboratory tests which distinguish between satisfactory and unsatisfactory lubricants. Information is given as to the methods of making the tests that were used in obtaining the comparisons, with cautions as to what should be observed if duplicate tests are to be obtained. The work was confined entirely to the grade of oil known as "extra light," with viscosities running from 135 to 165. This is the report of the prime movers committee's sub-committee on lubrication.—*Publication No. 24-77 of the N. E. L. A.*

News of the Industry

Illumination Practice Lags Behind Theory

Illuminating Engineering Society Convention Takes Stock of Progress —How to Apply Principles of Lighting Is Problem of Profession—Golf by Night

THE keynote of the address of President Clarence L. Law at the eighteenth annual convention of the Illuminating Engineering Society, which was held at Briarcliff Lodge, Briarcliff Manor N. Y., on Monday to Thursday of this week, was the obligation of the society and its members to engage actively in educational "propaganda" of the right sort so that there may be the most desirable progress in illumination practice based upon the principles which illuminating engineers have uncovered. "We are now entering into a period when the stage is set for even greater accomplishments than in the past," said Mr. Law. "We have encouraged research, formulated principles, and our most important function now is to promote educational propaganda—to demonstrate how properly to apply the knowledge we have obtained."

Mr. Law cited the great success of the training course in lighting just completed under the joint auspices of the I. E. S. and the Lighting Bureau of the N. E. L. A. as an example of a way to start. He also thought that the society could well consider its responsibility to investigate and report on alleged scientific discoveries or inventions relating to lighting and purporting to revolutionize the art and science.

It was found at the convention that there existed a general consensus of opinion among illuminating engineers that the chief problem ahead is to apply the principles which have already been established as the basis of good lighting. In other words, practice is lagging behind theory in illumination, forming a contrast with the situation in many branches of electrical engineering where practice has not only caught up with theory but is pushing it.

Few Advances Recorded

Up to Wednesday evening the convention had brought out very little evidence of recent advance in the science. Excellent papers were presented showing the state of the art in different lines and some little advance in practice was recorded. The report of the committee on progress gave in the usual clear and thorough manner an excellent picture of the progress during the year and of the principal happenings and accomplishments in that period. An analysis of the membership of the society in the general secretary's report showed that 90 per cent of the membership is connected with the utilization or commercial side of the industry.

In a very interesting session devoted to the subject of daylight Prof. H. H. Higbie of Michigan presented for the first time a comprehensive review of the distribution values and qualities of daylight as actually used. His paper was entitled "Predetermination of Daylight from Vertical Windows," but its usefulness is much broader. Of particular interest to central-station companies is the work directed toward recording daylight values in their relation to the amount of artificial light needed and the consequent effect upon lighting bills. Progress only could be reported, but future developments promise definitely useful results.

Illumination in Plant Growth

A session was held at the Boyce Thompson Institute for Plant Research on the status of knowledge of the relation of artificial illumination to plant growth. That plant growth can be stimulated has been shown. Its practical application at the present time, however, is limited to those who wish to produce expensive non-seasonal flowers for sale, and to the extent only that there may be a market for such flowers can the plan be said to be commercially practicable. That twenty-four-hour forced growth is inadvisable has been shown. It has also been learned that plants respond to the yellow and red light much better than to green and blue. Other technical information as to details of exactly how much extra growth can be expected or how much saving in time may be obtained was presented.

Considerable interest was manifested in the discussion of the example of high-intensity illumination found in the new lighting system of the McGraw-Hill Company's building. This was heralded as a constructive step in the direction of putting into practice some of the principles now accepted in modern illumination. This system is described in an article beginning on page 943 of this issue.

Show-window and display-case lighting received attention also. In the case of the latter, recommendations, based on surveys and experiments, were made by J. L. Stair and William Foulks as to intensities, wattages (in relation to heating the cases) and location and spacings. One experiment indicated that an increase of intensity from 10 foot-candles to 35 foot-candles in a given display case attracted 50 per cent more people to the case. Considering the cost of the entire display, the additional cost of light in this experiment paid for itself many times over.

In show-window daytime illumination Ward Harrison and Walter Sturrock showed that there is opportunity to apply artificial illumination to overcome the reflections usually found in show windows. From experiments performed a recommended series of intensities to be applied to show windows to overcome the reflections under different conditions was given.

Wednesday evening's session was devoted largely to some of the art features of lighting. Claude Bragdon made a plea for an "art" of lighting to be developed just like the art of music or painting. The illuminating engineer has supplied the tools, he said, and the opportunity is ahead to use them to create an art. Details of theater lighting problems and accomplishments were also covered to show that there is an are developing there. In discussing the problem of lighting for motion picture production W. B. Ihnen and D. W. Atwater showed how the illuminating engineer's principles were being used to create the necessary effects.

For Thursday sessions were scheduled in street lighting and traffic control and on some technical phases of speed of vision and glare and visibility.

Playing Golf by Night

The spectacular feature of the convention was night golf, under artificial illumination, with floodlighting units. How soon the average golf course will be lighted to suit the average player can hardly be predicted at this time, but the demonstration at Briarcliff this week showed that good players can play golf with artificial illumination. The first tee, fairway and green were floodlighted with about 20 kw. in lamps, giving an intensity as high as 10 foot-candles on the horizontal plane on the green. By throwing some of the light into the air over the fairway it was found possible to follow balls in the air with the eye. For spectacular purposes at the convention this lighting was supplemented by powerful searchlamps, which followed the balls in flight so that the entire crowd around the tee could watch most clearly.

The usual athletic entertainment events and social features were augmented by special events arranged by the local committees. By Wednesday evening about 310 had registered, which is forty more than the total registration of any previous convention.

Power Shortage Relieved

Rainfall Enables Northern California to Reduce Use of Steam—Outlook Promising in South

EARLY fall rains in California have very much relieved the power shortage situation. Five inches of snow has fallen at Summit, in the Sierra Nevadas, which is half as much as the entire precipitation for last year. The Pacific Gas & Electric Company and the San Joaquin Light & Power Corporation are now virtually out of

danger and have been able to reduce steam generation. Through a conservation policy northern California utilities have been able to meet the situation brought about by the abnormally dry year without curtailment of the consumption of electrical energy.

The Southern California Edison Company has been benefited by the rains in the San Joaquin Valley and the Big Creek watershed, and with the placing in operation of the first 35,000-kw. unit in the Long Beach steam plant scheduled for December 1, the end of the power shortage in southern California is in sight.

Civil Engineers Debate St. Lawrence Plan

Oppose Saddling Water Power with the Cost of Navigation Channel—Ice Troubles at Hydro-Electric Plants Another Main Topic at Convention

TWO subjects of interest to the electrical industry, and especially to hydro-electric engineers, occupied prominent places in the program of the fall meeting of the American Society of Civil Engineers, held in Detroit from October 22 to October 25. The first of these was the development of the St. Lawrence River for navigation and power purposes. The second was the troubles from ice encountered by hydro-electric plants.

Francis C. Shenehon, consulting engineer of Minneapolis, presented a comprehensive paper incorporating general principles involved in the best coordination of navigation and water power, taking into consideration the whole Great Lakes system. He discussed the assumption that water power should be charged with the cost of navigation development on the St. Lawrence River. There were only two conditions under which a possible justification of this assumption might be considered, and these were, first, that the development of water power would cause existing navigation structures and channels to become inoperative; second, that the benefits derived from the power developed would be shared by districts and interests identical with those benefited by the navigation works. The author's conclusion was that industry and other power users in the district bounded by Toronto, North Bay, Quebec, Boston and Rochester, should alone pay all of the cost of the navigation works, which would benefit primarily the district west and southwest of Detroit. Great and widespread benefits are, he said, received by all people and interests in the district affected by the production of power through the application of that power to industry; but the benefit derived from the power *per se* is usually small, accounting as it does in its tolls for less than 3 per cent of the business of the district. Thus power development is in the same category as navigation works, and instead of being forced to pay tribute, water power more fairly might be subsidized.

Keeping Projects Separate

H. de B. Parsons, consulting engineer of New York City, held that in reality two projects were linked together, first, a ship canal through the St. Lawrence to Lake Ontario, utilizing such power as can be generated at the dams, remodeling the Welland Canal and deepening interlake rivers and lake harbors by dredging and by lake-level regulation works; second, a hydro-electric power development between Montreal and Lake Ontario, using the ponds above the dams for navigation purposes, while the remodeling of the Welland Canal and the deepening of the interlake rivers and lake harbors would follow the use made by ship navigation. Although closely related, these two primary factors should be kept separate. Dams best suited for canalization necessarily would not be the same in height or location as those where power generation was the dominating factor.

Full Power of River Needed

There was little doubt, Mr. Parsons thought, that the full power of the river would be needed by the time that it was made available. The cost of development by private enterprise would be less than if constructed by the government. Benefit to private interests would be limited as the government would safeguard its rights and public service commissions would have a voice in regulating prices.

Gardner S. Williams, consulting engineer, Ann Arbor, Mich., was of the impression that all of the power that could be obtained from the water in this project would be absorbed as soon as it could be made available. Reports from the superpower zone in the East showed that the district included would take by 1930 a total of 3,200,000 electrical horsepower, the increase in steam-generated power from 1920 to 1930 amounting to 1,920,000 hp. The development of this power would be a source of revenue to Canada and subsidiary interests in this country. From another standpoint, if this power does not come from Niagara or the St. Lawrence, it must be generated by coal. In 1919 the superpower zone used the equivalent of 11,000,000 tons of coal. During the same period the central stations in Michigan, Indiana, Illinois, Wisconsin and Iowa used 10,700,000 tons of coal, so that the one would replace the other, and if the railways in the superpower zone were operated by hydraulic power, a much larger quantity of coal could be conserved.

Ice Trouble at Hydro Plants

John Murphy of Ottawa, Canada, electrical engineer with the Dominion government, talked of his twenty years' experience in fighting ice at hydro-electric plants on Canadian rivers. Slides showed the location of snow, clear ice, frazil ice and anchor ice adhering to the bottom of the river. Physical properties of water and the different kinds of ice were summarized and a chart showed how the temperature of the water lagged behind that of the air. When the temperature of the water approached the freezing point, then was the time to expect frazil ice. Wooden racks clogged just as readily as iron racks. Frazil ice would stick to anything, but wooden racks were easier to clean. The iron being a better conductor made ice readily when the water was near 32 deg. and the upper portion of the rack exposed to cold air. A remarkable photograph showed what may be expected in the way of ice formation when the racks, toil pipe and concrete structure in contact with the water are exposed to the air and not housed in as they should be. To loosen the ice it was necessary to raise the temperature of the parts in question only 0.001 deg. above freezing. The amount of steam required to do this was remarkably small. Taking a steam reserve plant of 3,000 hp. and a water development of the same capacity, the former consumed 144 tons of coal per day of twenty-four hours, while one ton of coal would keep the water plant free of ice.

John F. Freeman, consulting hydraulic engineer of Providence, R. I., discussed nucleation and agreed that a small amount of electrical energy would prevent the formation of frazil ice.

Gardner S. Williams referred to his experience on the Huron River in obviating constantly recurring damage from ice carried along at high velocity owing to a drop of 180 ft. in 30 miles. A series of slack water pools so cut down the velocity, he said, that little damage is now experienced from ice.

James S. Bowman, hydraulic engineer with the Fargo Engineering Company of Jackson, Mich., gave information on eliminating ice trouble at spillways caused by the direct thrust of the ice field, which may seriously damage the gates and runways, or from the freezing of ice on the upstream face of gates and on piers, which interferes with spilling and necessitates an extra force to put the gates in operating condition at the time of the spring break-up.

D. W. McLachlan, chairman of the Canadian section of the international board of engineers on St. Lawrence River development, declared that it would take more than 7,000,000 hp. in steam to melt 2 ft. of ice for a 48-mile stretch of the river.

Street-Lighting Tables for 1925

FOLLOWING its practice for thirty-six consecutive years, the ELECTRICAL WORLD is preparing tables showing the proper time for lighting and extinguishing street lamps. The tables for 1925 will be ready November 15, and a copy of them will be sent free to any subscriber upon request to ELECTRICAL WORLD, Tenth Avenue and Thirty-sixth Street, New York. For more than one copy a charge of 25 cents each is made to cover a portion of the postage, printing and compilation costs.

Kansas Has Banner Convention

Doubles Attendance of Any Former Year—Women Take Part for First Time—Human Relations, Rural Service, Commercial Policies, Small-Plant Problems

THE exceptionally good program presented on October 24 and 25 at Emporia, Kan., attracted and held double the attendance ever drawn before by a Kansas Public Service Association meeting. Two state commissioners and two mayors took part in the discussions, staying through the convention to become better acquainted with utility problems. Women of the utility industry attended the convention for the first time and participated in the discussions. Men from outside the state gave fresh viewpoints. Rural service received much attention, and addresses on research, sales practices, small-plant operating problems and superpower rounded out the proceedings.

A code of ethics for utility men was unanimously adopted, with the recommendation that it be posted conspicuously in every utility office and plant to remind utility men of their obligations and acquaint the public with the guiding principles of the companies.

Jesse Greenleaf of the Kansas Public Utilities Commission contended that state commissions should not try to substitute their judgment for that of utility managers but should serve as the instigators of conferences in which public and utility interests may be settled harmoniously and equitably.

E. T. Hackney, another member of the commission, said the utilities must start by convincing the public of their honesty.

Mayor Earl Hawkins of Emporia and Earl Akers of Topeka both expressed a sympathetic attitude toward electric utilities, and the latter confessed to a change of viewpoint. They pleaded for frankness toward the public and cooperation with it.

Good Relations Start at Home

A responsive chord was struck by J. F. Owens, president Oklahoma Gas & Electric Company, when he declared that public good will does not come from advertising utility policies, but by selecting, informing and training all employees so that they will carry out the policies and practices which make for public friendship and confidence.

Ways of obtaining better public relations through publicity were discussed at length by W. R. Kercher, Southwestern Bell Telephone Company, who presented an attractive picture of the opportunities for utilities to present their story to the public through newspapers; Keith Clevenger of the Empire District Electric Company, who discussed various means of overcoming misunderstandings, and Horace M. Davis, director of the Nebraska Committee on Public Utility Information, who dwelt on service as the keynote in public relations. Miss Isabel Davie, chairman of the women's public utility information committee, Middle West Division, N. E. L. A., explained what her committee is trying to do and how utilities can help recommending particularly the formation of company committees and the sending of women to state and national meetings.

Plans contemplated and under way for establishing rural service on an economical basis were discussed by Dr. E. A. Stewart, director of the Red Wing (Minn.) farm electrification project, who explained the fixed charge plus energy rate used in Minnesota, indicating its operation both when lines are (as preferred) financed by utilities and when they are financed by the farmers; W. W. Austin, chairman of the Kansas association's committee on relation of electricity to agriculture, who said the state utilities planned to finance entirely at least the preliminary work of the first year, and Dr. W. M. Jardine, president Kansas State Agricultural College, who outlined the contemplated early steps to be taken in collecting data and selecting favorable districts for electrification.

Merchandising and Refrigeration

A comprehensive paper on utility merchandising policy was presented by E. J. Emanuel, commercial sales manager Kansas Electric Power Company, Lawrence. To bring adequate profit from merchandise sales, utilities, he said, should establish a proper balance between floor sales, employee sales and outside salesmen.

What the domestic electric refrigerator will do for the home, consumer, and incidentally the utility, was the subject of an address by F. M. Dwelley, general sales manager Kelvinator Corporation, who told of the relative wattage consumption and revenue from different domestic appliances.

D. O. Vaughn, Kansas Electric Power Company, Lawrence, declared himself "sold" on the domestic refrigerator as a load. Domestic refrigerators are not a rich man's toy, he declared—they are being used in the smallest communities. As a means of increasing domestic loads from 25 or 40 per cent to 70 per cent they will be a godsend.

Small-Plant Operating Problems

The chief problem of small plants is lack of business, declared M. D. Leslie, Electric Service Company, Dodge City, Kan., coupled with the fact that they must have the same organization as large companies, have a lower prime mover economy and virtually the same rates. Still, his company has been able to make a system pay involving 175 miles of transmission line and serving only 5,000 people with 250 kw. peak load.

Metermen in small companies are continually listening to customers' complaints and answering questions, said C. E. Lakin, Kansas Electric Power Company, Lawrence. Consequently a good appearance, ability to meet the public and common sense are essential qualifications. Because of the long transportation necessary meters must be rugged. Records of history and tests are very important.

Citing the rural service and inductive-co-ordination investigations as examples of utility research, W. V. Lovell, engineer with the National Electric Light Association, said that electric power utilities, with a few exceptions, have not carried on researches of commercial value to themselves. He expressed the belief that the companies have confused pure research with applied research.

Roy Page, Nebraska Power Company, Omaha, spoke on "Superpower, Its Limitations and Possibilities," and G. H. Ahlborn, Kansas Gas & Electric Company, Wichita, on "Better Home Lighting."

All officers of the association were re-elected for the coming year, Robert H. Timmons, Kansas Gas & Electric Company, Wichita, being continued as president and H. Lee Jones, director of the information bureau, Kansas Public Service Companies, Topeka, as secretary. The next convention will be in Topeka, October 23 and 24, 1925.

One Thousand Medals to Supplement Home-Lighting Prizes

One thousand "honorable-mention" medals will be given by the Lighting Educational Committee in addition to the eleven prizes offered to winners in the international contest. The committee felt that since there would be about twenty-five thousand primers entered in the international contest eleven prizes were not enough. The thousand medals will be distributed to the winners according to districts, a certain number being apportioned to each region according to the number of towns organized in it.

The attached table shows the expenditure which is being made for the home-lighting contest in twenty-seven cities ranging in population from 2,000 to 600,000. The cost per capita ranges from 0.61 cent to 13.4 cents. This wide variance is due to newspaper advertising. Some communities did not do much advertising themselves, but relied on contributed space from central stations and dealers. With the publicity from newspaper articles, contributed advertising space, radio talks, motion pictures, etc., it is estimated that the combined publicity of the campaign will represent an investment of at least four million dollars.

	Population	Expenditure	Cost per Capita in Cents
Pittsburgh, Pa.	623,300	$5,250	0.84
Fort Worth, Tex.	165,000	7,500	4.54
Nashville, Tenn.	150,000	3,030	2.02
Wichita, Kan.	80,000	2,951	3.68
Huntington, W. Va.	65,000	1,592	2.44
Altoona, Pa.	60,000	893	1.48
Pittsfield, Mass.	52,280	542	1.03
Baton Rouge, La.	40,000	510	1.27
Jackson, Miss.	30,000	640	2.13
Pottsville, Pa.	22,000	632	2.87
Atchison, Kan.	14,000	172	1.22
Ilion, N. Y.	12,000	450	3.75
Bennington, Vt.	10,200	315	3.08
Lewiston, Pa.	9,849	356	3.61
Wooster, Ohio	9,000	400	4.44
Juniata, Pa.	7,660	47	0.61
Cleveland, Tenn.	7,500	355	4.73
Huntingdon, Pa.	7,051	106	1.50
Concordia, Kan.	6,000	175	2.91
Maquoketa, Iowa	5,000	270	5.40
Mount Union, Pa.	4,774	47	0.98
Hollidaysburgh, Pa.	4,071	47	1.15
Lenoir City, Tenn.	4,000	322	8.05
Patton, Pa.	3,628	74	2.03
Athens, Tenn.	3,000	347	11.56
Sweetwater	2,500	298	11.92
Ebensburg, Pa.	2,000	269	13.40
	1,399,813	$27,590	(av.) 1.98

Williams and Smith Tell of Public Interest in Show

Measured in terms of definite results, the seventeenth New York Electrical and Industrial Exposition, which closed on October 25, was most notable for the intelligent interest of the public in the practical applications of electricity. Commenting on this phase of the show, Arthur Williams, President of the Electrical Show Company, said to a representative of the ELECTRICAL WORLD that he was particularly impressed with the attitude of women visitors who came to make a serious study of the economic advantages of household electrical appliances, indicating that the public has begun to appraise these devices at their true value.

This same attitude was evident also among the fifty thousand people who inspected the replica of the fifteen-thousand-dollar prize home offered in the better-home-lighting contest. This was the United Electric Light & Power Company's chief exhibit, and Frank W. Smith, vice-president of the company, feels that this exhibit and the show as a whole have enabled his company to get closer to its customers than anything attempted in the past.

One of the most interesting and significant occurrences of the show was the actual sale of three electric pleasure vehicles. These had been exhibited along with commercial trucks with little thought that actual sales would result. Public interest, however, in the electric pleasure car was so great that the New York Edison Company plans a bureau to develop this business.

The exhibitors' satisfaction with the results of the show is evidenced by the fact that a number have already made space reservation for next year.

Public Exhibition of De Forest "Phonofilm" at Albany

A vaudeville entertainment presented by means of the De Forest "phonofilm" took place at the Capitol Theater, Albany N. Y., this week. Dr. Lee De Forest, who was associated with the first radio broadcasting station at the Metropolitan Opera House, has been working on his phonofilm for more than five years. Although private exhibitions have been given in his laboratory and sections of film have been shown at the Rivoli Theater in New York City, the Albany performance was the initial attempt to demonstrate the value of the new "talking movies" as a complete vehicle of entertainment in themselves.

The exhibition is said to have been entirely successful. Preliminary technical descriptions of the De Forest apparatus were published when the perfection of his system was first announced. What follows was prepared by W. E. Waddell, formerly manager Thomas A. Edison Kinetophone Studio and general manager American Talking Picture Company. In making the phonofilm the actor performs exactly as upon the speaking stage. A specially constructed microphone is concealed somewhere on the stage which picks up every sound he produces. This microphone is connected to a series of audion bulbs and is greatly amplified. From there it passes into an ordinary motion-picture camera. In connection with the camera a small gas-filled tube is used which fluctuates in exact accordance with the volume originating from the actor's lips. Between this gas-filled tube and the film is a fine slip $\frac{3}{32}$ in. wide and $\frac{3}{1000}$ in. thick. The light from the gas-filled tube passes through this fine slip, affecting the sensitive photographic emulsion of the negative, thereby registering the photographic sound waves in the form of horizontal lines. Of course, the ordinary motion-picture lens is photographing the picture of the actor simultaneously, thereby securing absolute synchronization of sound and action. Positive prints are now made from the negative so taken.

SOUND WAVES PHOTOGRAPHED IN DE FOREST "PHONOFILM"

In reproducing, a small attachment is placed on any standard motion-picture projector machine. This attachment consists of a 6-volt incandescent lamp which is so placed that its rays penetrate the fine slot, the same size as that used in the camera, and as the film passes by this slot the amount of light passing through the sound waves is governed by their density. These light rays now flow into another tube which is known as the thalofied cell. This cell has the duty of converting the light rays into sound waves. Inasmuch as they are very weak, they are passed through another series of audions, where they are amplified several hundred thousand times. These sound waves are then projected by means of a loud speaker to the motion-picture screen. The amount of volume is dependent upon the amount of light permitted to pass from the incandescent lamp to the thalofied cell. The operator in the booth will therefore give volume to suit any size audience or theater at will by simple adjustment of this light.

Directors of Holyoke Railway Vote to Sell Plant

Directors of the Holyoke (Mass.) Street Railway Company voted unanimously on October 28 to sell the company's power plant on the Connecticut River to the Turners Falls Power & Electric Company and make contracts with the last-named company for energy for operating the electric railway system. The sale price is said to be $400,000. The stockholders will meet November 18 to take action on the plan. As reported last week (page 905), this proposed sale has given rise to a fear on the part of the Holyoke Water Power Company that its territory may be invaded by the Turners Falls company, and the Massachusetts Department of Public Utilities has been appealed to.

Gospel of Electricity

Its Development Under Private Enterprise Is Vital to Civilization, Says W. H. Onken, Jr.

THAT electricity is revolutionizing virtually every phase of modern life and that its enormous benefits to civilization should be safeguarded and encouraged by permitting public utilities to function under the driving power of private enterprise were the fundamental points of an address made before five hundred members of the Boston Chamber of Commerce on October 23 by W. H. Onken, Jr., editor of the ELECTRICAL WORLD. The speaker pictured the vast development of the electrical art from almost insignificant beginnings, outlined the dependence of great industries and domestic affairs upon wired service, and emphasized the vital necessity of electrical energy in maintaining production and in creating new lines of manufacture to enrich mankind, to lighten the burdens of toil and to replace a dirty by a clean civilization. Because of the elasticity of the service and the way in which power can be made everywhere accessible, electricity can, the speaker said, render possible a healthier distribution of the people over the face of the country, and the attainment of this end depends in large measure upon wise methods of regulating utilities developed under popular ownership and private initiative.

Describing the controlling importance of electric service in industry, Mr. Onken showed its economic benefits in the fields of heating and power supply, citing the cardinal necessity of an adequate supply of electricity in the chemical and abrasive arts, in advanced metallurgy and many other applications. To cheap electricity is due the incredible development of the electrochemical industry during the last quarter century. High-speed steel, ferro-silicon, ferro-chromium and a notable group of abrasives are dependent upon electricity for their successful production, and without these the automobile industry and many others could not function on their present scale, if at all. Without grinding wheels utilizing material produced in the electric furnace, manganese steel would still be a metallurgical curiosity.

CONTRAST WITH EUROPE

In passing, the speaker contrasted the mighty development of the electrical industry in America with its relatively small development in Europe under the blight of government ownership. Here the per capita use is about 600 kw.-hr. per year, while in Great Britian under municipal operation it is only 150 kw.-hr. The Boston Edison company supplies more electricity than all the cities in England with the exception of London put together, and in the United States 95 per cent of all the electricity used is generated by privately owned companies, subject to rate and service regulation. Certain popular fallacies regarding water-power development in relation to steam-plant production were made clear by the speaker in closing, with commendation of the customer-ownership movement.

Need Water-Power Studies

O. C. Merrill Says Maximum Development of Hydro-Electric Resources Depends on Them

IF MAXIMUM use is to be made of the water-power resources of all streams, O. C. Merrill, the executive secretary of the Federal Power Commission, points out that there must be a change from the present haphazard development to a program of careful river studies. Recommendations to that effect were made in the report of the Roosevelt Inland Waterways Commission in 1908 and have been embodied in numerous bills introduced in Congress since. One of the more notable of these was that of Senator Newlands. None of these bills was approved finally, although a study along the lines of the Newlands proposal was authorized in the river and harbor act of 1917. No action was taken under that authority because of the exigencies of the war period, and the passage of the water-power act led to the repeal of the act. Late in the last session of Congress, however, Senator Ransdell of Louisiana introduced a bill which would enable the Federal Power Commission to undertake this long-time planning and make an exact inventory of the water-power resources of our streams along the lines which have been advocated for so long. While the Ransdell bill is more specific than is the water-power act, it conveys no additional authority to the commission. It does, however, provide the means whereby the commission may proceed with that part of the work which Congress intended it to do. In the discussion of the water-power bill Senator Jones of Washington, the chairman of the committee having jurisdiction over it, declared that the legislation was intended to cover the studies proposed by Senator Newlands.

There is a widely held opinion, Mr. Merrill points out, that our water-power resources are boundless. As a matter of fact the country now is using more power than the total of all developed and undeveloped water power available half of the time. Developed and undeveloped water power available half of the time amounts to 55,000,000 hp., Mr. Merrill estimates. Nearly 60,000,000 hp. was used in 1923 by industries and public utilities in addition to the amount employed in railroad transportation. In the Northeastern States water-power resources are much less than one-third of the power now being used. Another factor in the situation is that three-fourths of the country's water-power resources are west of the Mississippi, whereas more than three-fourths of power requirements are east of the Mississippi.

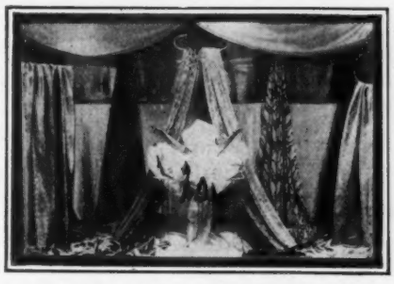
Conflicting Applications for Kentucky River Sites

M. Webb Offutt, W. J. Loughridge, R. T. Green and W. A. Heffner of Lexington, Ky., have filed application for preliminary permits covering the erection of power plants at each of the government locks from No. 8 to No. 14 inclusive on the Kentucky River and covering construction of a dam near Airdale, Ky., in the Kentucky River. The application applying to the government dams is in direct conflict with that filed September 29 by the Kentucky Hydro-Electric Company. It is estimated that 15,000 hp. can be developed at the dams mentioned. The Airdale dam proposed by Mr. Offutt and his associates is planned to go in just above the mouth of Middle Fork. The structure is to be of concrete, 85 ft. high. It will be possible to develop 20,000 hp. primary power at that point, according to the estimate.

C. R. Berry of Ketchikan, Alaska, has applied for a preliminary permit covering the erection of a dam in Fish Creek near the outlet of Big Lake. The water would be diverted to the power house at the upper end of Low Lake.

Italian Electrical Engineers for Better Lighting

The Italian Electrical Engineers' Association met at Spezia on September 25-30 for its twenty-ninth annual convention. The entire program was devoted to lighting questions, a circumstance attributed largely to the interest in this subject awakened by S. E. Doane, chief engineer of the National Lamp Works at Cleveland, during various trips abroad. Nearly thirty



MODEL SHOW WINDOW WHICH ATTRACTED NOTICE AT CONVENTION

papers on widely diversified lighting subjects were presented. Professor Sartori made an able presidential address.

A very important step was the adoption of a resolution recommending that all lamps be marked in volts, watts and lumens. In the past there has been more or less confusion due to some manufacturers using the international candle and others the Hefner candle as standard. Moreover, certain lamps have been rated in horizontal candlepower, others in downward candlepower, and some even in candlepower at 45 deg.

In the convention hall the Società Edison per la Fabbricazione delle Lampade had installed an effective lighting demonstration similar to those made in various cities in the United States by means of which it was possible to compare the lighting effects produced by different types of standard equipment. C. Clerici, the president of this company, which is a very important factor in the Italian electrical industry of Italy, explained the installation. Smaller demonstration units and a full-sized model show window with high-level, color and spotlight effects supplemented the exhibition.

The first technical session was devoted to a consideration of various questions regarding the production of light and photometry. Lamp manufacture, the physical properties of filaments, radio tubes and other topics were discussed. The second technical session had as its subject the utilization of light, and practical questions—such as the illumination of factories, tests on reflecting equipment, the effect of glare, the relation of light to production, etc.—were presented. In the remaining sessions the regulation of voltage and its effect on lighting, public illumination (including street lighting), special phases of lighting such as marine and aëronautical signaling and statistics on the lighting business of the country were the topics.

Interesting exhibits of lighting appliances were on view in the rooms adjoining the convention hall, in which American manufacturers were well represented. The principal streets of Spezia were provided with special lighting showing modern types of equipment in actual service. The installation of the Cia Generale di Elettricita was particularly extensive.

Department of Commerce to Study Interconnection

An intensive study of the legal aspects of electrical interconnection is being made by the Department of Commerce. This study is expected to make clear the legislative steps which must be taken to insure the maximum development of interconnection and the free movement of power across state borders. It is one of the steps being taken in anticipation of a meeting of the Northeast Superpower Committee, which will be held before the end of the year. Both at the Department of Commerce and at the Federal Power Commission there is a feeling that the effort to insure further interconnection in the Northeast should not be allowed to lag. While it is true that 45 per cent of the lines of the utility companies in that area are interconnected, only 8 per cent of the interconnections have a capacity sufficient for effective interchange of power.

The Federal Power Commission is particularly interested, since better interconnection is essential to the development of the available water power in the area. Despite the fact that the demand for power in the Northeastern region is increasing at a rate expected to result in the use of more than thirty billion kilowatt-hours in 1930, in addition to that which would be required for railroad electrification, yet less than 40 per cent of the region's water power resources have been developed. Another reason for expediting as much as possible the work of the Northeast Superpower Committee is the increasing need of preparation to supply when the time comes the forty billion kilowatt-hours which it is estimated could be used to advantage in railroad transportation. But perhaps the principal motive behind the committee is its realization of the great economies which

could be brought about by early and effective interconnection of the two hundred utility systems in the Northeast. With larger and more systematic high-voltage transmission, reserve equipment could be reduced, a better load factor attained and a higher factor of reliability insured.

Weymouth Plant Soon to Be on the Line

Rapid progress toward the initial operation of the new Weymouth generating station of the Edison Electric Illuminating Company of Boston is now being made, and it is anticipated that the installation will be delivering commercial energy to the system before December 1. The high-pressure boiler, piping and turbine equipment is likely to go into service in the latter part of the winter. Recently, upon invitation of the company, about two hundred editors and publishers of newspapers in eastern Massachusetts visited the plant to obtain concrete knowledge of the progress of the ten-million-dollar initial investment, and a little later some three hundred members and guests of the Boston Section of the A. I. E. E. went over the station.

Municipal Water and Power Plan for Denver

As a preliminary move toward the launching of a comprehensive water-power and storage project through the construction of two dams on the South Platte River in Colorado, engineers have been sent out by the Denver municipal water board to test foundations for the structure and check the rights for the sites recently secured by the board. The project provides for the storage of double the amount of water impounded by the present Cheesman dam and contemplates the diversion of considerable water from the western slope of the state at a cost of about $5,000,000. It is understood that a bond issue for this amount will be submitted at the next city election.

Present plans call for the utilization of the lost power in the South Platte River, which would be made possible by the two new storage reservoirs. The erection of a hydro-electric station above the proposed Eagle Rock dam would provide considerable power which could be sold by the municipality at a profit, thereby reducing the cost of operation of the water system. Inasmuch as the plans have been based on surveys made a number of years ago, it is possible that a change in them may be found necessary. Because of the increasing water consumption in Denver the municipal commission has, however, given notice that additional facilities must be provided, and present plants contemplate the construction and operation of a power plant which will utilize all available waters. By many this action is believed to be the first step in a municipal ownership project to be considered in 1926, when the franchise of the Public Service Company of Colorado expires.

Nebraska Supreme Court Upsets Electric District Law

The statute authorizing the establishment of rural electrical districts in Nebraska has been declared unconstitutional by the Supreme Court of that state. The law was enacted by the 1919 Legislature at the particular instance of a group of Saunders County farmers and a district was early formed and bonds voted. From the proceeds of the bonds, which were sold to an Omaha bank, a distribution system was built from Wahoo, from which place electrical energy is transmitted.

When a group of farmers in Platte County sought to organize a district, opponents took their objections into court and the Supreme Court first held the law was valid. Then districts in Washington and Dodge Counties and others in Saunders began to arrange for organization. In some cases elections were held and bonds voted; in other cases, notably in Seward County, bonds were defeated. Upon the attempt to organize a district near Arlington the Northwestern Railroad Company and others objected and asked a review of the Platte County case in the Supreme Court. The recent decision is a reversal of the original opinion.

Just what the effect may be on the Saunders County district, where the bonds have been sold and the line is in service, is not clear. This will probably become a matter for determination by the courts. The 1919 law was later held to be defective in some minor details and was amended in 1923 without the opposition of the private electric companies, which have sedulously kept free from any part in the controversy between the farmers wanting electric service and the taxpayers who did not want to be taxed for service they did not care to use.

Paris High-Tension Conference Issues Agenda

As already noted in the ELECTRICAL WORLD (August 30, page 433), the third international conference on large extra-high-tension electric supply systems will be held in Paris toward the end of next June. The agenda drawn up for this conference have now been made public and are as follows:

FIRST SECTION

PRODUCTION AND CONVERSION OF ENERGY

A. Plant and equipment of central stations and substations: (a) Alternators; (b) transformers; (c) switchgear; (d) insulators; (e) cables.

B. Parallel working of central stations: (a) Difficulties encountered; (b) influence of the characteristics of the circuits; (c) conditions to be realized; (d) solutions adopted.

C. Division of load between stations.

D. Characteristics of the auxiliary stations.

Open-air substations.

SECOND SECTION

CONSTRUCTION AND INSULATION OF THE LINES

F. Relation between pressure, length of line and the power to be transmitted.

G. Arrangement of the lines.

H. Poles: (a) Loading; (b) shape, dimensions, construction and erection; (c) strength of foundations.

I. Insulators: (a) Shape, dimensions and tests; (b) fastenings; (c) endurance; (d) fixing of the conductor; (e) distribution of the voltage on the insulator units; (f) study of the raw materials.

J. Conductors.

K. Jointing of the underground cables to aërial lines.

L. Experimental determination of the electric constants (self-induction, capacity, leakage, corona effects).

M. Underground and submarine lines: (a) Limit of the use of cables of one or more conductors, continuous or alternating current; (b) determination of electric constants; (c) test after installation.

THIRD SECTION

MAINTENANCE, SAFETY AND PROTECTION

N. Choice of transmission pressure; standardization of frequency.

O. Regulation: (a) Frequency; (b) pressure; (c) phase displacement; (d) sudden change of flow.

P. Excess current: (a) Purpose and use of induction coils; (b) relay coils; (c) short circuits to earth.

Q. Excess voltage: (a) Atmospheric; (b) internal; (c) earth connection of the neutral point; (d) protection of the insulators.

R. Supervision: (a) Maintenance of the lines in good condition; (b) finding and localizing faults; (c) cutting a defective line out of circuit.

S. Measurement of energy at extra high tension.

T. Telegraphic and telephonic communications, ordinary and wireless.

U. Administrative technical regulations; their internationalization.

California Commission Cannot Appraise City Plants

By a decision of the California Supreme Court the Railroad Commission of that state has been sustained in its refusal to assume jurisdiction of the power to make a valuation of the properties of the East Bay Water Company. The commission had decided that in view of a doubt raised as to whether the statute authorizing it to fix condemnation valuations for municipal utilities was not in conflict with the state constitution, it would not act until the courts had settled that point. The decision is of special interest to Sacramento, where the Municipal Utility Board has been endeavoring to obtain a commission appraisal of the properties of the Pacific Gas & Electric Company and the Great Western Power Company. This cannot be done under the court ruling. However, an amendment to the constitution will be voted on in November which, if carried, will remove the inhibition.

Rolla's Municipal Plant Goes to Mrs. Holcomb

On October 7 the citizens of Rolla, Mo., voted by 588 to 9 to sell their well-managed local municipal electric and water supply plant to Mrs. D'Arline Holcomb, famous in the central-station world as the only woman operator of electric utilities, and to her son-in-law, George E. Silver, and also granted the purchasers a twenty-year franchise. Rolla, which is a college town of 2,500 people, is the eleventh Missouri city to dispose in entirety of its municipal electric plant in the past three years. In that time also nine municipal plants have abandoned generation of electricity and have taken energy from large privately owned transmission line systems for distribution by the municipality. Besides this, more than 150 small private plants have become units in big systems.

Briefer News

Valmont (Col.) Plant Will Soon Be in Operation. — The first 20,000-kw. unit of the new twelve-million-dollar steam generating plant of the Public Service Company of Colorado on Boulder Lake, an artificial reservoir near Valmont, will, it is planned, go into operation early this month.

Nevada-California Gets Additional 21,500 Hp. — The Nevada-California Power Company, whose headquarters are at Riverside, Cal., on October 3 placed in operation its Levining plant No. 1. This gives it an additional 14,000 hp., to which 7,500 hp. additional is on the point of being added.

Tennessee Electric Power Buys Maryville Company.—The purchase of the property and franchise of the Maryville Lighting Company of Maryville, Tenn., by the Tennessee Electric Power Company has been approved by the Tennessee Railroad and Public Utilities Commission.

Portneuf (Quebec) Plant Absorbed. —The North Shore Power Company, a subsidiary of the Shawinigan Water & Power Company, operating in a district east of Three Rivers, Quebec, has, as predicted last week, purchased the municipal power plant formerly operated by the municipality of St. Raymond, Portneuf County.

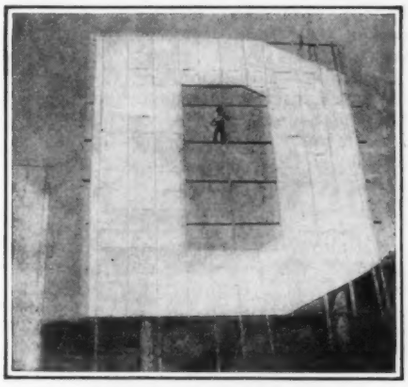
Another Unit Goes Into Service at Brooklyn, N. Y.—Last week the Brooklyn Edison Company put into service the third 62,500-kva. turbo-generator to be installed in the company's new Hudson Avenue station, which, as previously recounted in the ELECTRICAL WORLD, is eventually to have eight such units.

Muskogee Renews Franchise of Oklahoma G. & E. Company.—By a vote of four to one, citizens of Muskogee, Okla., voted on October 14 to renew for twenty-five years the electric franchise of the Oklahoma Gas & Electric Company, which expires in 1926. The company and its predecessors have furnished electric service in Muskogee for more than twenty years.

Washington Water Power Company's Two-Million-Dollar Program. — Line crews of the Washington Water Power Company operating north and east of Spokane are making rapid headway on the Long Lake-Spokane 110,000-volt transmission line, which is one unit of the company's two-million-dollar program of expansion, the most extensive ever undertaken by it in one year. The new line, which for the present will be operated at 60,000 volts, will eventually supply part of the power for the Chicago, Milwaukee & St. Paul Railroad when it electrifies its eastern Washington division. Construction of an outdoor 20,000-kw. substation at the east city limits of Spokane has begun.

Attleboro, Mass., Rejoices in New Lighting System. — Attleboro, Mass., where the question of a better lighting system played a prominent part in the last city election, has just achieved the object for which its citizens voted in the inauguration of a "white way," which was made the occasion of a general celebration. All-night lighting has also been adopted for the first time in the city's history. The new lighting system involved an outlay of $150,000 by the Attleboro Steam & Electric Company and will cost the city $11,000 more yearly than the antiquated plant it supersedes.

Cost of Upkeep on 548-Ft. Sign.— Figures given out on the cost of the 548-ft. sign built on the side of the foothills back of the Hollywood section of Los Angeles show that it costs $600 a month to operate. This sign, which bears the single word "Hollywoodland" and was erected to further real estate operations, is 45 ft. high and contains 3,553 bulbs. It can be seen from a distance of 33 miles and read at half that distance. The picture shows a single letter of the sign.



Pennsylvania Borough Takes Over Light and Power System.—The Superior Court of Pennsylvania has upheld the action of the Public Service Commission of that state in granting permission to the borough of Conneautville to acquire, maintain and operate the electric light, heat and power line now being operated in that borough by the United Lighting Company, and proceedings for an inventory are under way.

Abilene, Tex., Will Have "White Way."—The new street-lighting system of Abilene, a city of 15,000 people in north central Texas, provides modern ornamental standards for seven miles of streets. The West Texas Utilities Company, which furnishes power to Abilene, made the installation. Included are 483 single-lamp standards and a few bracket types for special places. In the business district the posts are mounted six to the block, opposite each other. In the residential section there are three to the block, in staggered formation. The lighting units are General Electric "Novalux" fixtures.

Philadelphia Plans Ornamental Lighting of City Streets for Sesqui-Centennial Celebration.—Instead of the familiar court of honor, those in charge of preparing lighting designs for the Sesqui-Centennial celebration to be held in Philadelphia in 1926 are reported to have in view a plan for ornamental illumination of the main arteries of the city, this lighting to be continued for an indefinite period after the celebration is over. Under the program being considered more than five hundred city blocks will be decorated with ornamental standards averaging eight to the block and bearing colored lamps of high power. The standards will serve as guideposts to the city. Triumphful illuminated arches are planned for the urban "gateways."

Arkansas Company Changes Hands. —The Central Power & Light Company of Walnut Ridge, with general headquarters at St. Louis, recently purchased the Mammoth Springs Electric Light & Power Company and will, it is reported, spend $1,000,000 improving the properties and extending the lines. Dam No. 2 on Spring River will be reconstructed and a new dam will be built below Dam No. 3, which furnishes energy to a number of north Arkansas and south Missouri towns. Transmission lines will be extended to Hoxie and Walnut Ridge, Ark., on the south and Willow Springs, Mo., on the north.

Hydro-Electricity Will Replace Steam if Olean Company Buys Cattaraugus (N. Y.) Plant.—Joint application has been made to the New York Public Service Commission by the Cattaraugus Electric Light & Power Company and the Olean Electric Light & Power Company to permit the sale of the former to the latter. It is set forth that if the petition is approved the Olean company will be able to supply hydro-electricity to the customers of the Cattaraugus company at lower rates than they now pay for the purchased steam-generated energy of the latter company, which operates only in the village of Cattaraugus. The Olean company has franchises in Olean, Allegany and nine other places.

Seattle Has Difficulty in Fixing Price for Street-Railway Substations.—After a deadlock lasting nearly a year, the board of arbitration created to fix a valuation on the North Seattle and Fremont substations of the Puget Sound Power & Light Company, Seattle, has submitted a divided report to J. D. Ross, Superintendent of Lighting for the city. In the terms of the contract under which the city purchased the street-railway system from the company the city was permitted to take over the street-railway load of approximately 25,000 kw. in blocks of 5,000 kw., giving the company one year's notice of such intent. The first notice of intent to take over the first block of 5,000 kw. was given the company two years ago, and the two substations mentioned above were designated. Two of the arbitrators, one appointed by the company and one selected jointly by the city and the company, have fixed a price of $141,317 for the equipment in question. The third arbitrator, appointed by the city, submitted a minority report placing the valuation at $111,317. Superintendent Ross

points out that the responsibility for the decision rests with the City Council and recommends that the city, "if it can be done legally, accept the present arbitration and start immediate condemnation proceedings for the other five substations that will be taken over under the contract."

Potomac Company Enlarges Plant.—Two hundred prominent Washingtonians were the guests of the Potomac Electric Power Company the other day when an addition to its generating plant went into service. The addition consists of an extension of the turbine room and electrical gallery, in which has been installed a 20,000-kw. General Electric turbo-generator with the necessary auxiliaries. A new boiler house contains three Babcock & Wilcox boilers with underfeed stokers. These additional facilities have cost $1,800,000. The Potomac company now has in its main station nine turbo-generators with a total capacity of 118,000 kw. The company operates twenty-three substations. The plant was built originally in 1906 with two 5,000-kw. units.

Westinghouse Builds First Diesel Electric Tug.—A Diesel electric tug, the first ever built, has recently been put into service at Jersey City for the Pennsylvania Railroad and has exhibited, observers say, remarkable quietness, smoothness of operation, ability in maneuvering and strength in towing. Its propulsion machinery consists of two Winton full Diesel six-cylinder, four-cycle engines with a 13¼-in. bore by 18-in. stroke. Each engine drives a Westinghouse 235-kw., 250-volt direct-current shunt-wound and separately excited generator and a 25-kw., 250-volt, compound-wound, 260-r.p.m. exciter. These Diesel generating sets supply power for the double-unit propulsion motor driving the single-screw propeller 125 r.p.m. at full towing speed.

Ambitious Scheme for Mississippi River Improvement.—The River Power & Transport Association from the Lakes to the Gulf has been formed at St. Louis with Captain George Mearer as "general organizer." Among its objects is the improvement of the Mississippi with low-head hydro-electric power plants and dams from the Ohio to the Illinois River. Four huge dams are planned. Connected with the scheme is a proposal to hold a world "electric centennial" in St. Louis in 1929 to commemorate the fiftieth anniversary of the incandescent lamp. This exposition would cost, it is estimated, $50,000,000, of which the United States government is to be asked to bear half, the remaining cost to be borne by the city, the state and the electric industries of the nation.

United States Chamber of Commerce Reiterates Stand on Public Utilities.—Among other resolutions summarizing policy which were passed at the mid-year meeting of the Eastern Division of the Chamber of Commerce of the United States, held last week at Washington, was the following: "The Chamber of Commerce has already declared itself to be in favor of private ownership and operation of public utilities, under government regulation. This position was taken after careful study and thorough consideration. Questions in this field have been before the meeting. The facts which have been given with reference to them confirm the wisdom of the chamber's position, and this Eastern Division meeting unqualifiedly declares in favor of that policy."

New England Appliance Bureau Plans Winter's Work.—Under Chairman Richard Lincoln, assistant superintendent of the appliance department of the Edison Electric Illuminating Company of Boston, the Appliance Bureau of the New England Division of the N. E. L. A. has scheduled the following luncheon discussion meetings at Boston for the coming season: November 10, "Christmas Merchandising and What It Means to Electric Service Company Revenue," R. Lincoln, chairman; December 1, "December the Opportune Month," Cyrus Barnes; January 5, 1925, "Start the Year Right—Education and Compensation for Your Sales Department," E. L. Olds; February 2, "Advertising and Man Power," G. E. Nickerson; March 2, "Why I Bought an Electric Range," L. A. Fiorani; April 6, "How to Sell Electric Refrigeration," O. R. Underhill; May 4, "How to Fill Up the Summer Valley," G. P. Luscomb. With the exception of November the luncheons will be held at Engineers' Club, starting at 12:30 p.m. The place of the November meeting will be announced later.

Rochester Gas & Electric Plans for Dam in the Genesee. — Preliminary plans for its projected dam at Mount Morris on the Genesee River are to be made by the Rochester Gas & Electric Company under the direction of Chester W. Smith, an authority on dam construction. This, however, officials of the company explain, does not mean that it is intended to begin construction as soon as the plans are ready. Actual building must await an increased market, they say. If the dam were to be built immediately, it would cost $11,000,000. It would be 1,000 ft. long at the top and 600 ft. at the bottom with a height of about 170 ft. and would make a lake extending from a point about a mile above Mount Morris to within a half mile of the lower falls of the Genesee. This lake would range from 1,000 ft. to 5,000 ft. in width. About 15,000 continuous horsepower could, it is said, be developed at the dam, and the power stations within the Rochester limits that depend upon the now uncertain phases of the river for their operation would be operated almost at uniform capacity throughout the year.

Grand Falls (N. B.) Plant Will Cost $5,000,000 Initially.—Premier Venoit of the Province of New Brunswick assured a delegation recently that the Grand Falls water power will be developed. The survey has been completed and the provincial forestry department is now making a survey to determine the damage to forests which would be involved. A petition will be presented to the International Waterways Commission probably before December, and plans of the areas affected are being prepared by engineers of the New Brunswick Hydro Commission. The initial development will, it is said, involve an expenditure of at least $5,000,000. Several plans will come up for consideration, including (1) developing the power in New Brunswick alone without affecting any riparian owners, (2) developing the power in New Brunswick and Maine, (3) developing an all-Canadian system in New Brunswick and Quebec and utilizing all the power in New Brunswick, Quebec and Maine.

Engineering Foundation Gets Bequest of $50,000. — The Engineering Foundation will receive $50,000 by the will of Henry R. Towne, according to an announcement by Charles F. Rand of New York, chairman of the Foundation Board. The bequest was made to the United Engineering Society as the trustee of the Engineering Foundation funds for the four national societies of civil, mining, mechanical and electrical engineers. "This bequest," Mr. Rand said, "establishes the Henry R. Towne Engineering Fund, the income of which is to be expended by the Engineering Foundation Board for the purposes stated in its charter—'the furtherance of research in science and in engineering, or for the advancement in any other manner of the profession of engineering and the good of mankind.'" Mr. Towne was an engineer and manufacturer, a past-president of the American Society of Mechanical Engineers and active in its affairs. For many years he was a close friend of Ambrose Swasey, the founder of the Engineering Foundation. Mr. Rand also announced the appointment of 190 engineers in twenty-seven cities as local representatives of the Foundation to aid in carrying on nation-wide research effort. The appointees, all of whom have accepted, represent forty-one national and local engineering societies and include men prominent in industry and education.

Coming Meetings of Electrical and Allied Societies

[A complete directory of electrical associations is published in the first issue of each volume. See July 5 issue, page 50, for latest list.]

Associated Manufacturers of Electrical Supplies — Association office and Hotel Roosevelt, New York, Nov. 10-14. F. Nicholas, 30 East 42d St.

National Association of Railway and Utilities Commissioners — Phoenix, Ariz., Nov. 11-14. James B. Walker, New York Transit Commission, New York.

West Virginia Public Utilities Association—Charleston, W. Va., Nov. 14-15. Bliss McCrum, secretary.

National Electrical Credit Association (Middle and Atlantic States)—Philadelphia, Nov. 14. F. P. Rose, Marquette Bldg., Chicago.

Electrical Supply Jobbers' Association —Hotel Cleveland, Cleveland, Nov. 19-21. Franklin Overbagh, 411 South Clinton Street, Chicago.

American Society of Mechanical Engineers—New York, Dec. 1-4. C. W. Rice, 29 West 39th St., New York.

Western Association of Electrical Inspectors — Brown Hotel, Louisville, Ky., Jan. 27-29. G. M. Miller, 1304 South Seventh St., Louisville.

Men of the Industry

George Higginson, Jr., who was for many years in charge of the Chicago office of Stone & Webster, Inc., having severed his association with that organization, has retired from business.

Russel Bowles, who has been manager of the Lake Superior District Power Company's electric properties at Washburn, Wis., has been transferred to assume the managership of the company's properties at Mellen, Wis.

Emilio Puig, local manager of the Brownsville (Tex.) Light & Power Company, has been appointed manager of the Laredo Electric & Railway Company, effective November 1. Mr. Puig retains the managership of the Brownsville company in addition to assuming his new duties in Laredo, his headquarters.

Fred F. Ludwick, secretary of the Warren division of the Ohio Public Service Company for the past six years, has been transferred to the main office of the company in Cleveland, where he will assume broader responsibilities as assistant treasurer.

Daniel T. Lennon, director of customer service in the Pawtucket division of the Blackstone Valley Gas & Electric Company, has resigned to affiliate himself with Homer W. Gray, broker, of Pawtucket. Mr. Lennon has been in charge of the sale of securities to local customers for some time.

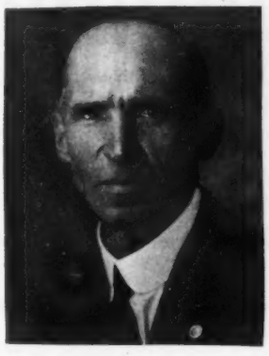
R. E. Cox, associated with the Cleveland office of the Ohio Public Service Company, has been transferred to the Warren division in the capacity of secretary to succeed Fred F. Ludwick, who has assumed new duties in the Cleveland office. Mr. Cox was previously in Warren for a short time during the formation of the Ohio Public Service Company, later going to Cleveland.

J. A. Leonard, who has been actively identified with the design and construction of the major hydro-electric developments of the Central Maine Power Company during the past decade, has been appointed hydraulic engineer of the Bangor (Me.) Railway & Electric Company, with headquarters at Bangor. Mr. Leonard was on the engineering staff of the latter company prior to his connection with the Central Maine organization. His most recent work has been in connection with the construction of the Skowhegan station and redevelopment of the Messalonskee Stream for the Central Maine company.

Laurence A. Hansen, formerly assistant chief of the Domestic Commerce Division of the federal Department of Commerce and author of the department's series of bulletins dealing with American retail practice, the first studies ever made by the United States government of the problems of the merchant, has joined the staff of *Electrical Merchandising* and *Electric Retailing*, McGraw-Hill publications. He will make for those papers special studies and reports of retailing problems in the electrical field similar to those he carried on in general retailing for the government and the Massachusetts Retail Merchants' Association, relinquishing the managing directorship of the last-named organization to take up his new editorial duties. At one time Mr. Hansen was detailed to Berlin by the State Department for the purpose of compiling there special reports in imports and exports.

J. W. Andree Made Superintendent of Production

J. W. Andree, formerly operating engineer of the Southern California Edison Company, has been made general superintendent of production. Mr. Andree joined the operating forces of the company in 1910 as an engineer in the department of generation, and in



J. W. ANDREE

1920 he was advanced to the position of assistant superintendent of generation. One year later he was given the title of operating engineer, which he has retained until his recent promotion. Born in Germany in 1879, he came to this country in 1883 and was graduated from the University of Illinois in 1907. After a short association with the Arnold Company of Chicago, where he engaged in general construction work, he entered the service of the Commonwealth Edison Company before affiliating himself with the Los Angeles utility.

H. F. Spreen, who has been in the office of the superintendent of lighting of the Eastern Texas Electric Company, Beaumont, has resigned to join the forces of the Fort Worth (Tex.) Light & Power Company. Both these properties are under the management of Stone & Webster, Inc., Boston.

M. F. Simmons, assistant to the vice-chairman of the manufacturing committee, has been named supervisor of production for the General Electric Company, succeeding W. B. Curtiss, who recently died. This announcement was made recently by Vice-president G. E. Emmons, to whose staff Mr. Simmons will be assigned. Mr. Simmons has been in the employ of the General Electric Company for twenty years, during fifteen of which he was in charge of the cost department at Schenectady. At one time he was assistant to the manager of the Schenectady works. His office will be in Schenectady.

Joel D. Justin, a well-known hydraulic engineer, who for the past year has been connected with the engineering department of the Northern New York Utilities, Inc., and the Power Corporation of New York, Watertown, has just signed a contract with the government of Formosa to act as consulting engineer on the construction of a huge earth dam for irrigation purposes. He has obtained a leave of absence from his present position covering one hundred days and he will sail from San Francisco on November 20.

Obituary

Henry J. Crowley, general manager of the American Electric Power Company, Philadelphia, formerly the American Railways Company, died at his home there October 27, in his fifty-ninth year. Mr. Crowley was widely known as an electrical engineer and had been associated with the American Railways Company since 1899, the date of its organization, later becoming a vice-president. The name of the company was changed in 1923 to its present title, the American Electric Power Company. His first electrical experience was with the Schuyler Electric Light Company, where he engaged in constructing electric lighting plants in New England, Pennsylvania and Ohio. In 1888 Mr. Crowley affiliated himself with the Thomson-Houston Electric Company, later becoming district manager of the General Electric Company at Atlanta, Ga. After serving for three years in that capacity he went to the company's office in Philadelphia as railway manager, spending six years in close contact with its railway business in Philadelphia, Pittsburgh, Harrisburg, Baltimore, Washington and Richmond. It was in 1889 that Mr. Crowley was appointed general manager of the American Railways Company, and subsequently, as a vice-president of that utility, he was in charge of construction of plants and of the operation of about thirty subsidiary corporations in twelve states. Mr. Crowley was a native of Unionville, Conn., and a fellow of the American Institute of Electrical Engineers.

Henry C. Wallace, Secretary of Agriculture in President Coolidge's Cabinet and by virtue of his office a member of the Federal Power Commission, died at Washington on Saturday, October 25. In his death the water-power act lost one of its most ardent supporters. As a member of the commission Secretary Wallace consistently favored accepting all the responsibilities vested in it. He was very definitely opposed to the commission's non-action on the Girand license and to the indefinite postponement of action on Colorado River projects.

Financial and Corporate

Utility Market Quiet

Price Changes Small, but the Gains Outnumber the Losses Over General List

THE approach of election day at times has seemed to encourage a waiting attitude on the part of many utility traders, and such an attitude was evident in certain quarters last week. During some sessions the absence of buyers resulted in small declines for issues that were being pressed for sale. None the less, taken as a whole, the week ended with utility values approximately a point higher than they had begun. Both in the utilities market and the general market, however, securities have not been dealt in with any great enthusiasm in recent sessions.

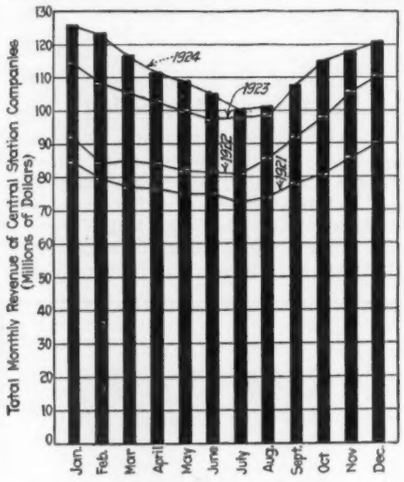
It would not take a long list to include the issues that advanced more than a point during the week under review. Perhaps the sharpest individual gain was the eight-point rise of Arizona Power preferred, an issue that is not among the most important and that has come into investment prominence only within recent months. The common shares of this company gained two points. American Power & Light Company's new stock, which is one of the most active issues on the whole list, improved its position only a quarter of a point for the week. Appalachian Power improved its position three points. That is not so significant as the fractional rise in American Power & Light shares, however, since Appalachian is not so heavily dealt in. Continental Gas & Electric rose four points and Commonwealth Power Corporation's common shares, under good buying, advanced two and one-half points. A wider interest is developing in the stock of the Alabama Traction, Light & Power Company.

Gains of about a point for the week were achieved by the stocks of such companies as Adirondack Power & Light, Georgia Light, Power & Railways, Lehigh Power Securities, Northern Ohio Electric and Northern Ontario Light & Power. Middle West Utilities lost two points.

August Revenue 6.3 per Cent Above Last Year

Reports received by the ELECTRICAL WORLD from central-station companies representing approximately 75 per cent of the generator rating of the country indicate that the average daily gross revenue from the sale of energy during August totaled $100,300,000, or a daily average of $3,240,000. This is an increase of 6.3 per cent above August of last year. The total increase was, however, $26,500,000, or 21 per cent under the record revenue received in January of this year, and was 7.4 per cent below the ELECTRICAL WORLD'S estimated normal revenue for that month. This is the second continuous month during which the revenue has been below the estimated normal.

Every section of the country except New England continues to report revenue above last year. New England reported a loss of 1.8 per cent, and the other sections report gains of 7.6 per cent, 4.8 per cent, 11.8 per cent and



FINANCIAL GROWTH OF THE INDUSTRY HAS BEEN RETARDED THIS YEAR

11.7 per cent, for the Atlantic States, North Central States, South Central States and Mountain-Pacific States respectively.

The operating expenses during August totaled $50,600,000, and the operating ratio of systems having steam-electric generating plants only was 53.7 per cent as against 55.2 per cent in August last year.

Company Reports

Among the company reports issued during the past week for the month of September are the following:

Name of Company	Gross Revenues for September 1924	1923
Alabama Power	$752,973	$721,677
Arkansas Central Power*	166,810	164,192
Associated Gas & Electric	585,448	297,299
Bangor Railway & Electric	127,534	128,192
Cities Service	1,054,200	1,025,587
Commonwealth Power	2,449,500	2,491,842
Consumers Power	1,445,442	1,417,434
Cumberland Co. Power & Light	317,807	307,608
Galveston-Houston Electric & subsidiaries*	337,662	276,642
Georgia Railway & Power	1,280,633	1,284,043
Grafton County Elec. Lt. & Pwr.	17,807	15,952
Great Western Power	635,296	585,645
Houston Lighting & Power*	243,382	206,813
Idaho Power	280,539	240,712
Knoxville Power & Light*	181,649	174,100
Manchester Traction, Light & Power and subsidiaries	199,946	202,332
Massachusetts Lighting	305,161	296,659
National Power & Light & sub.*	1,718,505	1,699,703
New Orleans Public Service*	1,124,221	1,097,181
Northern Ohio Electric	826,630	777,584
Pennsylvania Power & Light*	1,232,190	1,107,243
Pine Bluff Company	74,775	75,067
Portland Electric Power	859,472	886,481
Public Service of New Jersey	7,014,854	4,954,381
Republic Railway & Light	825,621	806,927
Southwestern Power & Light*	941,767	860,933
Staten Island Edison	216,821	198,481
Tennessee Electric Power	766,992	758,033
United Gas & Electric	1,134,308	1,118,623
Utah Power & Light	799,460	725,150
Virginia Railway & Power	834,626	859,469
Washington Water Power	438,635	430,874

* August.

Bond Issue Approved

The application of the Public Service Electric & Gas Company, Newark, N. J., filed with the State Board of Public Utility Commissioners, as was announced in a recent number of the ELECTRICAL WORLD, was approved and authority was granted to issue the first mortgage and refunding 5½ per cent bonds amounting to $15,000,000 and maturing in 1964. Of these securities bonds totaling $5,248,000 are to be issued in exchange for a similar amount of 5½'s due in 1959 now held by the Public Service Corporation. The commission withheld permission to issue 2,000,000 shares of common stock of no par value.

Consolidated Company of Baltimore

Having Trebled Its Business in the Last Decade, the Consolidated Gas, Electric Light & Power Company Modifies Its Set-Up

BY PAUL WILLARD GARRETT

THE Consolidated Gas, Electric Light & Power Company of Baltimore is one of the more important Eastern utilities with a long record of improvement and one that has done especially well in more recent years. The company's electric business dates back to 1881 and its gas business to 1816. Several things have contributed to the growth of the company during the last decade and account for an increase in the gross business from $6,400,896 in 1914 to $22,221,699 in 1923 and in net from $3,067,075 to $9,633,107. Among these should be mentioned the great growth of the South, and particularly that of the Baltimore region which the company serves.

During the war period the Baltimore company, in common with many others, was obliged to raise new capital for plant expansions through the flotation of short-term issues. Between 1919 and 1923, however, the company shrewdly set about putting its financial house in more permanent order. It redeemed $20,000,000 of short-term notes through the proceeds received from the sale of bonds and stocks. The ratio of bonds to stock in the capital structure was improved through increasing the equity of the stockholders. In 1919 no less than 76 per cent of the capitalization was represented by fixed obligations; by 1923 the proportion had been reduced to 68 per cent. More and more the company has been able to raise funds through stock flotations. In the 1919-1923 period the total of new capital put into the property was $15,535,000, but to do this the company increased its bonded debt only $5,622,000. The other $9,913,000 was raised through the sale of stock. There is another point to note in connection with the fact that the company is reducing the relative volume of fixed obligations. It is that the average interest rate

Stock and Bond Quotations of Electric Light and Power and Manufacturing Companies

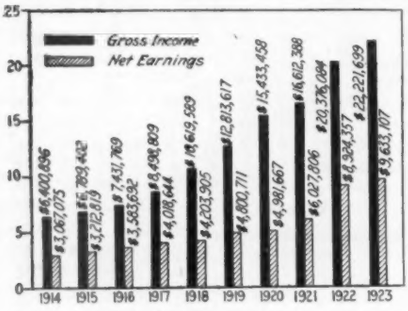
(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par value of stocks is $100.)

Companies	Bid Price Saturday, Oct. 25	Low 1924	High 1924
PREFERRED STOCKS			
Operating Companies			
Adirondack Power & Light 7 per cent	97	94	97½
Appalachian Power, 7 per cent	90	85½	90
Arkansas Light & Power 7 per cent	90	81	93
Asheville Power & Light 7 per cent	96	96	99
Carolina Power & Light 7 per cent	99	95½	101
Central Illinois Public Service 6 per cent	84	84	87
Colorado Power 7 per cent	93	90	98
Connecticut Light & Power 7 per cent	103	99	106
Consumers' Power 6 per cent	90	85	93
Dayton Power & Light 6 per cent	84	84	90
Duquesne Light 7 per cent	106	103½	107½
Eastern Texas Electric 6 per cent	100	81	100
Empire District Electric 6 per cent	73	70	78
Fort Worth Power & Light 7 per cent	99	97	102
Great Western Power 7 per cent	98	96	99
Illinois Northern Utilities 6 per cent	82	82	87
Illinois Power & Light 7 per cent	92	84	95
Kansas Gas & Electric 7 per cent	93	92	97
Long Island Lighting 7 per cent	99	95	99
Minnesota Power & Light 6 per cent	89	78	89
Mississippi River Power 6 per cent	87	80	90
Nebraska Power 7 per cent	96	89	99
Niagara Falls Power 7 per cent—25	a 27½	27	29
Niagara, Lockport & Ont. Power 7 per cent	101½	99½	104½
Northern States Power 7 per cent	94½	91	97
Ohio Public Service 7 per cent	94	86	100
Pacific Gas & Electric 6 per cent	90	85½	92½
Penn-Ohio Power & Light 7 per cent	91	84	96½
Pennsylvania Power & Light $7—no par	98½	93	99
Penn. Public Service 7 per cent	90	90	100
‡Philadelphia Electric 8 per cent—25	a 37½	29⅛	39⅛
Southern California Edison 8 per cent	116	112	120
Tennessee Electric Power, 6 per cent	78	71	81
Texas Power & Light 7 per cent	97½	95	97½
Utah Power & Light 7 per cent	95½	94	96½
Western States Gas & Electric 7 per cent	80	78	85
Yadkin River Power, 7 per cent	96	94	97½
Holding Companies			
American Gas & Electric 6 per cent—50	44½	41½	46
American Light & Traction	92	91	94½
American Power & Light 6 per cent	89	84	91
American Public Service 7 per cent	88	84	92
American Public Utilities 7 per cent	90	73	90
American Water Works & Electric 6 per cent	a 98	66	99
Associated Gas & Electric	a 48	48	50
Carolina Power & Light 7 per cent	98	95½	99½
Central Indiana Power 7 per cent	88½	80	92
Cities Service 6 per cent	78	67	78
Commonwealth Power	a 75½	72	82
Consolidated Gas 6 per cent—50	57	51	59½
Continental Gas & Electric 7 per cent	89	69	93
Electric Bond & Share 6 per cent	102	96½	103
General Gas & Electric—$8—no par	101	96	103½
Middle West Utilities 7 per cent	91	80	91
National Power & Light—$7—no par	93½	84	96½
North American 6 per cent—50	a 47½	43⅜	50⅛
Northern Ohio Electric	a 24	16	34
Public Service Corp. of N. J. 7 per cent	99½	96½	100½
Public Service Corp. of N. J. 8 per cent	107½	99½	110
§Standard Gas & Electric 8 per cent—50	48⅜	46½	49½
‡United Gas Improvement—50	57½	55½	58
United Light & Power—$6.50—no par	82	75⅛	84
COMMON STOCKS			
Operating Companies			
Adirondack Power & Light—50	32½	22½	34
Appalachian Power—no par	71	66	93
Arkansas Light & Power	60	22	63
Brooklyn Edison	a 118	107½	120
Buffalo General Electric	151	118	155
Carolina Power & Light	233	82½	245
Colorado Power	33	21	35
Commonwealth Edison	132	126	135
§Consolidated Gas, Electric Light & Power	a 34	33½	34
Dayton Power & Light	153	70	160
Detroit Edison	a 109½	102½	110½
|| Edison Electric Illuminating of Boston	a 179	163½	190
*Kentucky Hydro-Electric	87½	84	87½
Long Island Lighting	160	100	195
Mississippi River Power	32½	18½	34
Montana Power	a 65	61¼	71
Niagara Falls Power—no par	42	42	48
Niagara, Lockport & Ontario Power—no par	51	45	59
Northern Ohio Electric—no par	8	5	16
Northern States Power	101	92	106
North Texas Electric	58	58	84
Pacific Gas & Electric	a 95	90½	99⅞
‡Penn Central Light & Power—no par	60	57	60
Pennsylvania Water & Power	107	98½	110
‡Philadelphia Electric—25	a 37½	29	39⅛
Public Service Co. of Northern Illinois	97	97	104
Puget Sound Power & Light	50	43½	61½
Southern California Edison	99	95	106
Tampa Electric	a165	134	165
Tennessee Electric Power—no par	37	20	43
Virginia Power	55	16	70
Virginia Railway & Power	60½	36	72¾
West Penn. Co.	a 83	47½	98
Holding Companies			
‡American Electric Power—50	62	22½	62½
American Gas & Electric—no par	83	43½	97
American Light & Traction	137½	115	148
American Power & Light	43½	34½	48½
American Public Utilities	85	35	97
American Water Works & Electric	a112	40	126½
Carolina Power & Light—no par	230	103	240
Cities Service	141	140	155
Columbia Gas & Electric—no par	a 44½	33	44½
Commonwealth Power Corp.—no par	104	56	109
Consolidated Gas—no par	a 70⅞	60⅜	75½
Continental Gas & Electric	82	49	96
Federal Light and Traction	86½	75	86½
General Gas & Electric	55	22	63
Lehigh Power Securities—no par	80	31	89
Middle West Utilities—no par	76	41	86
National Power & Light—no par	160	60	190
Philadelphia Co.—50	a 48½	42⅜	53½
Power Securities—no par	9	4	14
Public Service Corp. of N. J.—no par	a 61½	39	63
Standard Gas & Electric—no par	a 38	31½	40½
United Gas & Electric (Conn.)—no par	27	14	42
Utah Securities	a 31⅛	16⅛	37
BONDS			
Operating Companies			
Adirondack Power & Light	6s 1950	102½	97½ 103
Alabama Power	5s 1946	95½	90⅛ 96½
Appalachian Power	5s 1941	95	89 95½
Brooklyn Edison	5s 1949	a100½	97½ 102½
	6s 1930	a105	102½ 106½
	7s 1949	a107½	107 110⅛
Cleveland Electric Illuminating	5s 1939	100½	98½ 101
Commonwealth Edison	5s 1943	99½	95 100
	5s 1953	98½	92 99½
§Consol. Gas, Elec. Lt. & Pwr.	4½s 1935	94½	91½ 95
	6s 1949	105	102⅛ 105
Consumers' Power	5s 1936	98½	94⅜ 99½
	5s 1952	a 90½	87 92⅛
Detroit Edison	5s 1933	a101½	99 101½
Duquesne Light	6s 1949	a105½	103⅛ 106½
Great Western Power	5s 1946	95	90⅛ 96
Kansas City Power & Light	5s 1952	a 94½	89 95⅛
Mississippi River Power	5s 1951	96½	92 97
Montana Power	5s 1943	a 98⅛	95 98⅛
New England Power	5s 1951	99	97 100
New York Edison	6½s 1941	a113	109⅜ 113
Niagara Falls Power	6s 1950	105½	104 105⅜
Northern States Power	5s 1941	a 93⅜	89½ 94½
	6s 1941	103½	101 104½
Ohio Power	7s 1951	106	103 106½
Pacific Gas & Electric	5s 1942	a 94½	90⅜ 95
Pennsylvania Water & Power	5s 1940	99	96 99½
‡Philadelphia Electric	5s 1966	a 101	97 103½
	5½s 1947	a 104½	99½ 104½
	6s 1941	a 107½	103½ 107½
Portland Electric Power	6s 1947	a 94⅛	89½ 97
Southern California Edison	5s 1939	99½	96 100
	6s 1944	102½	100 103½
Tennessee Electric Power	6s 1947	a 98	93½ 98⅜
Texas Power & Light	5s 1937	96½	91½ 96½
Toledo Edison	7s 1941	a 109½	106 109⅜
Utah Power & Light	5s 1944	a 93	87½ 93½
Holding Companies			
Alabama Traction, Light & Power	5s 1962	80½	65½ 83
American Gas & Electric	6s 2014	95	94 95½
American Power & Light	6s 2016	94½	91 94½
Amer. Water Works & Electric	5s 1934	a 92⅜	84½ 94
Associated Gas & Electric	6½s 1954	a 92½	92½ 94½
Central Indiana Power	6s 1947	94½	88 95
Commonwealth Power	6s 1947	a 97½	87 98
Consolidated Cities Lt., Pwr. & Tr.	5s 1962	75½	64 76½
Illinois Power & Light	6s 1953	99	95 100½
United Light & Railways	5s 1932	94	87½ 94
	6s 1952	96	92 97½
ELECTRICAL MANUFACTURING COMPANIES			
PREFERRED STOCKS			
Allis-Chalmers Manufacturing	a 99½	90	100¼
*National Carbon	118½	112	125
Worthington Pump & Machinery (A)	81	68	85
COMMON STOCKS			
Allis-Chalmers Manufacturing	a 57½	41½	66½
American Bosch Magneto—no par	a 26½	22½	38½
Electric Storage Battery—no par	a 57⅜	50⅜	64
General Electric	a252	193½	281
General Electric—10	a 11	10½	11½
*Hurley Machine—no par	60	48	65½
†Wagner Electric	23	20	34½
Westinghouse Electric & Manufacturing—50	a 62	55½	65
Worthington Pump & Machinery	a 42½	23¼	47½
BONDS			
Canada General Electric	6s 1942	107	102½ 107
General Electric	3½s 1942	83	80 83⅜
	5s 1952	a105½	100 105½
Robbins & Myers	7s 1952	70	70 91½
†Wagner Electric Manufacturing	7s	101	97 101
Western Electric	5s 1944	a 99	96 99
Westinghouse Electric & Mfg.	7s 1931	a108½	106½ 109⅜

*Chicago Stock Exchange. †St. Louis Stock Exchange. ‡Philadelphia Stock Exchange. || Boston Stock Exchange. § Baltimore Stock Exchange.
a Bid price Wednesday, October 29.

represented by the fixed obligations is only about 5.5 per cent.

The company has spent something like $50,000,000 on plant extensions since 1910, when the present management assumed control, and these far-sighted expenditures are beginning to show in greatly increased values behind the company's securities. The funded debt of the Consolidated Gas, Electric Light & Power Company of Baltimore and the subsidiary preferred stocks represent an aggregate value of $59,550,000. The three series of preferred



FINANCIAL GROWTH OF THE BALTIMORE CONSOLIDATED HAS BEEN CONTINUOUS

stocks of the parent company itself represent another $11,000,000. In addition, there is an issue of $17,500,000 of common stock that is listed on the New York Stock Exchange and that has been paying an 8 per cent dividend.

COMMON NOW IN SMALLER PIECES

About ten days ago, on October 21, the stockholders of the company held a special meeting to make some alterations in the old capital structure. At that meeting the stockholders did two things that many other utilities have done in recent months. These two steps have to do with the division of the common shares into smaller pieces and the substitution of stock without par value for the old stock of $100 par value. The new plan of the Consolidated Gas, Electric Light & Power Company of Baltimore is not complicated. It involves simply the issuance of four shares of no-par-value common stock for each share of the outstanding $100 par-value common.

While there is nothing particularly new about the Baltimore plan, it does represent another important step in the general movement nowadays on the part of utility companies to popularize their securities. The old stock on the big board ran up to 156 at one time, a price too dear, it was believed, for purchase by ordinary investors. The division of the stock into smaller units is designed to make it available to an increasing number of small investors. As a part of the plan to strengthen the market for its senior issues, the company recognizes the importance of a broad market for the common stock.

Byllesby Interests Form New Company

H. M. Byllesby & Company have announced the organization of a new holding company, an engineering and management concern, for public utility companies and hydro-electric sites located so as to supply large interconnected power sources. The new organization, which will be under the control of the Standard Gas & Electric Company and H. M. Byllesby & Company, will be known as the Standard Power & Light Corporation. It will purchase properties only after exhaustive analytical surveys.

Dividends Declared

The following quarterly dividends were announced by central-station companies during the seven-day period ended October 28:

Name of Company	Per Cent	When Payable
American Superpower, pf	1¾	Nov. 15
Brooklyn Edison	$2	Dec. 1
Cape Breton Electric, pf	3	Nov. 1
Cities Service, pf. & pf. B*	½	Dec. 1
Cities Service, com. (in cash scrip)	½	Dec. 1
Cities Service, com. (com. stk scrip)	1½	Dec. 1
Duquesne Light, 1st pf., ser. A	1¾	Dec. 15
Eastern Shore Gas & Elec., pf	2	Dec. 1
Edison Elec. Illum. Co. of Brockton	62½c	Nov. 1
Illum. & Power Securit es, com	45c.	Nov. 10
Illum. & Power Securities, pf	1¾	Nov. 15
Kaministiquia Power	2	Nov. 15
Knoxville Power & Light, pf	$1.75	Nov. 1
Lowell Electric Light	62½	Nov. 1
Montreal Light, Heat & Power Con.	1¾	Nov. 15
Montreal Light, Heat & Power Co.	2	Nov. 15
Nor. Mexico Power & Devel., pf	7	Nov. 1
Pacific Gas & Electric, pf	$1.50	Nov. 15
Pacific Lighting, com	$4	Oct. 31
Pacific Lighting, pf	$1.25	Oct. 31
Portsmouth Power, pf	1¾	Nov. 1
Public Service Elec. Power, pf	1¾	Nov. 1
Southern California Edison, com	2	Nov. 15
West Penn. 7% pf	1¾	Nov. 15

*Monthly

Utility Flotations Total $72,000,000

Amount of Electric Light and Power Offerings During the Month of October Shows a Decrease Under Figures Reached in Previous Month

DURING the month of October new offerings of electric light and power securities aggregated $72,059,000, as compared with $83,998,000 for the month of September. The decline in the volume of new issues was not unexpected after the brisk activity of the three previous months. The largest single offering was the twelve-and-a-half-million-dollar issue of general and refunding mortgage bonds of the Detroit Edison Company. It is interesting to note that, although heretofore this company's vehicle for bond financing has been its first and refunding mortgage, the authorized limitation of this security having gradually come within reach, the company has now created what is for it an altogether new form of mortgage, the general and refunding mortgage.

Among the other utilities offering sizable issues were the Continental Gas & Electric Company to the amount of $11,700,000, the Ohio Public Service Company to the amount of $9,000,000 and the Los Angeles Gas & Electric Company to the amount of $6,000,000. The financing was almost exclusively of a long-term nature.

SECURITY ISSUES OF ELECTRIC SERVICE COMPANIES IN OCTOBER

Name of Company	Amount of Issue	Period, Years	Class	Purpose	Interest Rate	Price	Per Cent Yield
Public Service Co. of No. Illinois	$5,000,000	40	First lien and refunding mortgage gold bonds, series B	To reimburse for construction expenditures and for corporate purposes	5½	96	5.75
Salt River Valley Water Users' Association (Ariz.)	2,500,000	14-19	Serial gold bonds	Construction	6	100	6.00
	2,243,000	12-30	Guaranteed bonds	Construction	6	...	5.40 to 5.50
Lockport Light, Heat & Power Co. (N.Y.)	1,100,000	30	First mortgage gold bonds, series A	Refunding and to provide for betterments	5½	99½	5.55
Northwestern Public Service Co.	1,332,000	24	First mortgage gold bonds, series A	Construction	6½	100	6.50
Ohio Public Service Co	9,000,000	30	First mortgage and refunding gold bonds, series D	Acquisition of properties and for other corporate purposes	5	89	5.75
	1,000,000	1	Gold notes	Acquisition of properties and for other corporate purposes	5	100½	4.70
Continental Gas & Electric Corp. (Neb.)	11,700,000	40	Secured gold bonds, series A	Proceeds to be used for acquisition of additional securities	6½	99	6.55
	4,000,000	..	Prior preference stock		7	92	7.61
New York Central Electric Corp.	2,000,000	..	Cumulative preferred stock	Acquisition of stock of another company	7	97½	7.18
Memphis Power & Light Co. (Tenn.)	490,000	..	Cumulative preferred stock	Working capital	7	98	7.14
Detroit Edison Co.	12,500,000	25	General and refunding mortgage bonds	To retire floating debt incurred for construction	5	97½	5.18
Middle West Utilities Co.	1,960,000	..	Prior lien stock	Acquisition of properties and general corporate purposes	7	98	7.14
Calumet Gas & Electric Co.	2,500,000	30	First and refunding mortgage gold bonds, series A	Acquisition of properties	6	97	6.20
American Power & Light Co.	5,000,000	92	Gold debenture bonds	Working capital and other corporate purposes	6	94½	6.35
Los Angeles Gas & Electric Corp.	6,000,000	25	General and refunding mortgage gold bonds, series I	Additions	5½	96½	5.75
Minnesota Power & Light Co.	2,200,000	..	Cumulative preferred stock	Construction	7	98	7.14
Wisconsin Power & Light Co.	784,000	..	Cumulative preferred stock		7	98	7.14
Continental Power & Light Co.	750,000	3	Gold notes		6	99	6.35
Total	$72,059,000						

Commission Rulings

Rules for Extensions at Customers' Cost Should Provide for Refund When New Consumers Come on Lines.—The Wisconsin Railroad Commission has held in adjudicating a complaint against the Willow River Power Company that rules requiring the original consumers to advance the cost of a connection are manifestly unfair unless they provide for a refund when additional consumers come on the lines. Provision for service to future applicants should be made with a corresponding rebate to those who have originally paid for the extension.

Present-Day Reproduction Cost Refused as Valuation Basis.—Ruling that it will not accept the present-day reproduction cost of properties as a valuation basis, the Wisconsin Railroad Commission has fixed the valuation of the properties of the Ashland Water Company at $620,734 as the rate base instead of $1,000,000 set as the value by the company on present reproduction costs. Although there are exceptions to the rule, officials of the commission point out that the general policy of placing the valuation of utility properties at pre-war construction costs, plus a reasonable advance for extensions and improvements, has been adopted by it. The ruling is the outgrowth of the company's petition for higher rates to net a better return on the investment.

Advantages to Customers from Interconnection and "Massed Production."—In granting authority to the Commonwealth Edison Company to construct a transmission line, the Illinois Commerce Commission dwelt upon the economy of large-scale electrical production. "Modern practice and economical operation," it said, "call for the installation of generating units of large capacity (30,000 kw. to 50,000 kw. per unit). As any such unit is installed at any one or several interconnected stations it is possible, by reason of such interconnection, to load such unit to approximately its full capacity as soon as installed, thus eliminating the idle investment which would otherwise exist if large units were to be installed at each station at the same time and be operated at considerably below capacity until the demands of the public for electrical energy should increase sufficiently to absorb the capacity of all units so installed. . . . The building of the large interconnecting transmission line involved in the present case, or 'superpower' line, is in line with the present modern tendency toward the so-called superpower systems. The public derives substantial benefit from a superpower system, such as that arising from the interconnection of the two large central-station systems of petitioner and the Public Service Company of Northern Illinois, in being able to draw upon the reserve capacity of any connected generating station in the combined system. Thus, if a disturbance occurs in the generating service of any portion of the system, such as the breaking of a turbine or a boiler, the interruption to service in that portion of the system is shortened, and may even be entirely avoided, by securing energy over the tie lines connecting that portion with other portions of the system. Furthermore, the public derives the advantage of lower rates by reason of the economies inherent in massed production."

Death of Commissioner Does Not Invalidate Order in Case Which He Had Heard.—The Colorado law provides that three commissioners must participate in all orders. Owing to the death of a member of the commission an order was recently promulgated in a railroad rate case (Denver Gas & Electric Light Company against Colorado & Southern Railway Company) which was signed by only two members, though three had heard the case. The Colorado Public Utilities Commission has declared the decision valid, but the question, which was raised in a test case, may be taken to the courts.

Recent Court Decisions

Company's Duty to Warn Employees of Independent Contractor of Danger.—In a damage suit in which an electric railway company, a firm of independent contractors and a surety company were codefendants (Reinee vs. Galveston-Houston Electric Railway Company) and which involved the death from electric shock of an employee of the contracting firm, the Court of Civil Appeals of Texas held that when the railway company employed the contractors to reconstruct a causeway upon which the company carried high-voltage uninsulated wire it owed a duty to the employees of the contractor to warn them of the danger inhering in the wire. In the absence of sufficient evidence that the company had done this, the court sustained its liability, even though it was shown that the victim knew that the wires were uninsulated and that it was dangerous to come into contact with them. (264 S.W. 783.)*

Ohio Franchise Tax Held Unconstitutional by Supreme Court.—The Ohio franchise tax has been declared unconstitutional by the United States Supreme Court, as violative of the interstate commerce clause and of the equal protection amendment, in a suit instituted by the Air-Way Electric Appliance Corporation. The company, a Delaware corporation, manufactures electric household appliances at Toledo. Among other things, the Ohio law applying the tax provides for an assessment upon non-par-value stock issued by corporations doing business in that state. In the case at issue the company had 400,000 shares of stock authorized, but only 50,485 shares issued. Its property at Toledo was valued at $450,000. For the fiscal year 1921 it reported sales of approximately $250,000, of which 72 per cent were interstate in character. It was assessed $20,000 franchise tax at the rate of 5 cents per share on the total authorized for the corporation. The company applied for an injunction. The federal district court held that this amount included interstate matters which should have been excluded, fixed the amount to be assessed at $14,426 and issued an injunction against collection of an amount in excess of this sum. Both sides appealed. Both the state officers and the lower court were in error, the Supreme Court declared, on the ground that the assessment in each case was greater than the total number of shares issued. Beyond this, the court held that the law was violative of the Constitution in the two points that the company had alleged. The case was reversed with instructions that a permanent injunction against collection of the tax be issued.

Rules Governing Federal Court Inquiries Into Alleged Confiscation.—Premising that the federal courts are without power to revise or correct orders of state public service commissions unless they be plainly confiscatory, the United States District Court of Nevada sustained the Public Service Commission of that state in a suit brought against it by the Reno Power, Light & Water Company to upset rates fixed for water service. The court made the following among other observations: Rates established by a state public service commission are presumed to be fair and reasonable, and the burden of proving the contrary rests on the party attacking them. In determining the reasonableness of rates the original cost of property, the amount expended in permanent improvements, the amount and market value of bonds and stock, the present as compared with the original cost of construction, the sum required to meet operating expenses and the probable earning capacity of the property under the particular rates prescribed are all elements to be considered. The rule requiring the base value fixed to be reasonable and the rate of return to be fair means not merely fair and reasonable for the instant, but for some reasonable period in the future. While reproduction cost at the time of inquiry is an important element to be considered, it is not alone controlling, especially when at the time prices are abnormal, nor is any other one element determinative, but all should be given due consideration. Brokerage is not a legitimate element of construction cost. A company may not capitalize a deficiency in net income below what would have been a fair return in one year as development cost or going-concern value on which it is entitled to earn fair returns in subsequent years. Rates which enable the company to make net earnings of 7 per cent will not be held confiscatory. (300 Fed. 645.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Manufacturing and Markets

The Local Code Committee—What It Does

A New Influence in Behalf of Fair Competition that Will Strengthen and Simplify Code Improvement and Promote Inspection Uniformity

By A. Penn Denton

Chairman National Electrical Code Committee, Association of Electragists International

IT APPEARS that the "local electrical code committee," although already established in 102 cities of the United States, is a rather mysterious thing to most electrical men not in direct touch with the work of the Association of Electragists International. In a word, it is a committee organized for the purpose of insuring fair competition between electrical contractors — electragists — in the community and to exert an influence for the more uniform interpretation of the National Electrical Code and for greater standardization in inspection.

What is it the electragist needs most when he undertakes to sell a first-class electrical installation? It may be the wiring and equipment in a five-room bungalow, or it may be a twenty-story office building involving every kind of known wiring material and construction equipment in use today. We will assume that this man has capital, experience and other requisites, including a splendid reputation and a well-established business, but if there is one thing lacking, he cannot conduct a satisfactory or successful business. This most important and necessary attribute to his business, absence of which handicaps all else that he has at his command, is fair competition.

But fair competition can be guaranteed only by the co-operation of the electrical industry and the inspection departments in each municipality, because:

First—In order to submit an intelligent estimate the contractor must have a well-designed and well-specified wiring layout.

Second — He must have the assurance of the moral support of the electrical men and the inspection interests in his community so that when he figures on the job the owner or his architect will expect him to furnish exactly what the wiring plans and specifications call for, as well as require him to live up to the letter and the spirit of these specifications in the installation.

Third — He must be guaranteed that the local inspection department will require of his competitor the same careful observance of electrical installation standards in this electrical wiring contract as would be required of himself.

A. Penn Denton

Lack of Contact

Experience has long proved that there has been a missing link between the electrical inspection department of our cities and the electrical industry. Manufacturers and jobbers are well aware of this fact. We have all seen sub-standard electrical materials sold and installed while we stood by and offered little, if any, objection. The electrical interests in cities where such practices have been going on were more to blame than the electrical inspector himself.

This Association of Electragists International believes that the growth and development of the electrical construction business to its present proportions has now made necessary a closer and better contact between our industry and the electrical inspection interests of this country through the creation of the "local electrical code committee." We believe the organization of one of these committees in every city and town throughout the country, backed by a united electrical industry, can absolutely assure an improvement in the standards of electrical installations and a condition of fair competition.

Purpose and Personnel

The local code committee should have as its purpose, first of all, to aid in the enforcement of the local electrical ordinances and the National Electrical Code rules. It should also act as a committee to receive complaints of violations of the electrical code and should be responsible for seeing that such violations are corrected, aiding the office of the local municipal and underwriters' inspectors in this work. It can also be expected to have a part in preparing and obtaining the passage of new electrical ordinances in those cities where these may be needed, though in the larger cities where electric leagues or clubs may have legislative committees this latter function more properly belongs to such a legislative committee.

The personnel of a local code committee should include a contractor as chairman, a representative of the service department of the local power and lighting company, the municipal inspector and the underwriters' inspector. These four men make the contact in serving the public electrically, and it is hoped that they, acting as a committee, will support the work of the municipal inspector in order to bring about more uniformity in installation work and a stricter observance of National Electrical Code rules. It is recommended also that as advisory members of the local code committee there should be selected one jobber's representative and one manufacturer's representative. This recommendation is made for the particular reason that we want the standing of the representatives on the local code

committee—the active members as well as the advisory members—thoroughly to represent and to receive the complete support of the united electrical industry and the insurance interests.

The local code committee should be organized either on the initiative of the local contractors' association or by the electric club or league. Up to this time, the organization of these committees in cities throughout the United States and Canada has been undertaken by the Association of Electragists International, under the supervision of its national code committee chairman, in the belief that the work of the local code committees will strongly support the work of the N. F. P. A. electrical committee responsible for the National Electrical Code.

It is the hope that after these committees have been functioning for a year's time all future changes in the code can be passed upon by these local code committees and that through them information can be obtained from the different branches of the electrical industry and the inspection interests which it has been impossible to obtain in any previous revision. All this means that the future revisions of the National Electrical Code will be more carefully and thoroughly made, which will in turn bring a decided improvement and more uniformity in changing and adding to our engineering standards for installation work and more uniformity in rulings by inspection departments.

A Good Example

As an example of the value of the local code committee the following occurrence is cited:

A certain city about a year ago organized a committee at just the time the 1923 code was issued. At the first meeting of this local code committee it was unanimously agreed by all interests represented that they should immediately accept the latest rules of the National Electrical Code and try to have them enforced as rapidly as possible.

The first subject discussed was brought up by the representative of the central-station company. He asked that the committee consider the use of the standardized safety-type service switch, with locking cabinet and meter trim. It actually took just three meetings of the local code committee—one of these a joint meeting with the local contractors' association—to arrange for the adoption of this type of service switch. Directly thereafter the central-station company issued strict orders requiring this safety-type locking service switch and meter trim in all classes of electrical installations in that city.

The same code committee next undertook to decide upon a uniform method of grounding as regards both the electrical system and the electrical equipment, this being another improved rule of the 1923 code. It took considerably longer for the committee to agree upon this rule, as the inspection department having jurisdiction had been permitting both the water-pipe grounding and the driven ground. It required six months' time for the committee to complete all phases of this investigation, but the final result was that the inspection department made a mandatory rule on grounding which requires each electrical system and the equipment to be separately grounded and both grounds attached with approved ground clamps on the service side of the water meter. No other method of grounding is permitted in that city, and the result has been most satisfactory to the contractor because every contractor knows just how much material will be required and to just what point he will have to run in installing the grounding conductor.

A third matter taken up by the code committee was the rule requiring all branch-circuit light wiring to have an identified or white wire for the neutral or grounded conductor of every circuit. The discussion of this particular subject brought out the fact that here was a rule in which the manufacturer and jobber were involved, and it was found desirable to call them in to conference in an advisory capacity. It was necessary to determine what manufacturers were making this identified wire, and, further, arrangements had to be made with the jobbers to allow them ample time in which to stock this wire before the inspection department could require the contractors to install it. Today this city's inspection department requires the use of the identified wiring on every class of light wiring. Thus the co-operative spirit, combined with careful and conscientious team work between the electrical interests and the inspection department, has placed electrical installations in the city concerned on a super-standard basis.

Commerce Year Book for 1923 Now Ready

THE Commerce Year Book for 1923 issued by the Department of Commerce has been available for distribution since October 29. Bound copies may be purchased for 85 cents from the Superintendent of Documents, Washington, D. C. In the summary of the section devoted to electrical equipment and materials it is stated that the production of electrical equipment and material during 1923 exceeded the former record made in 1922, and, according to an estimate based upon information received from reliable sources within the industry, totaled approximately $1,150,000,000, an increase of about 50 per cent over 1922. While the prices of many items in this industry remained at the same level, there was in general a slight downward trend as compared with 1922. Exports of electrical goods were greater in 1923 than during the year previous, the gain being well balanced throughout the range of production. While electrical imports on the whole were not large, there was a marked increase in the importation of incandescent lamps.

Survey of Trade Associations

MEMBERS of various associations of the electrical industry will be interested to know that the organization of commercial and trade enterprises into trade associations has assumed colossal proportions. In connection with its studies of trade association activities, the National Industrial Conference Board estimates there are between 800 and 1,000 trade associations of national or interstate character in the United States. In arriving at this conclusion it has been necessary to define the dividing line between trade associations and other types of voluntary organizations not conducted for profit.

The latest list of commercial and industrial organizations issued by the Department of Commerce, with which the board co-operated, contains slightly over 11,000 names, and the present analysis of the board shows that about one-tenth of this number can be classified as true trade associations. Of the 11,000 organizations listed by the Department of Commerce 1,500 were interstate national or international, 2,000 state and 7,700 local organizations, and it

is not feasible, remarks the board, to estimate on the basis of these figures the number of state and local trade organizations in existence. The board points out that chambers of commerce, merchants' associations and similar organizations constitute the vast majority of the organizations so listed and that many local organizations are only subsidiary units of larger associations and their inclusion in any estimate of the extent of trade organizations involves duplication.

In view of recent legislation touching upon the relation of government to business and the regulation of business by government, this analysis of types of trade associations is an important feature of the board's attempt to clarify for the public and business community the present situation in the relation of trade co-operation and the federal anti-trust policy.

This report, the first of a series, deals primarily with the economic and legal limits of voluntary co-operation among trade competitors, and as trade associations have become recognized as a representative medium for ameliorating trade abuses and improving industrial activity, the definition of what is a true trade association is of vital interest to business.

Business Conditions

PRESENT sales are classed by electrical manufacturers as good, with central stations actively purchasing auxiliary power apparatus, and in addition several good orders are in view. Many negotiations are under way with industrial plants, but there is little closing of contracts, although it is evident that most of the projects covered by these negotiations must eventually go through. Much of this hesitation is due to the proximity of the presidential election, although there is no good reason to believe that our fundamentally sound business policies will be affected by it. Recent reports of a decrease in business by two of the largest electrical manufacturers have been followed by the report of another manufacturer that his sales for the nine-month period ended September 30 show a decrease of 13 per cent from the same period last year. However, the Allis-Chalmers Manufacturing Company in its quarterly earnings statement reports the net earnings in the current nine-month period, after full reservation for federal taxes and other possible contingencies, as showing an increase of 30.1 per cent over the same period last year.

Confidence in the general business situation could not have been more aptly expressed than in the action of the United States Steel Corporation this week in declaring an additional 50-cent dividend on the common as well as the regular distribution, although there has been a decrease in earnings. To offset this, however, the iron and steel business has shown a distinct improvement since September 30. In addition, industrial and utility bonds offered during the last two weeks have been readily absorbed.

In New England business has hesitated slightly, apparently owing to the election, but sales of supplies are holding up very well. Jobbers in this district are reporting increased activity. Central-station purchases of auxiliary apparatus are active in the New York district and many good orders are in view. In the Southeast a satisfactory business is reported, and the textile situation is improving, with some electrifications of that industry anticipated. The volume of business is good in the Middle West, but the tone of the market is cautious. On the Pacific Coast industrial purchases are individually small but in the aggregate good. Fall rains in the state will, it is hoped, lead to the early lifting of power restrictions.

Electrical Appliance Demand Improving Decidedly

THE demand for electrical appliances since early in the year has been slow, but since the latter part of August there has been a decided improvement in inquiries as well as in orders. As far as heating devices are concerned, one company reports that its August sales were nearly equal to those of last year and the prospects were very good for a fair business during the remainder of the year. The holiday trade demand is now being felt, and some good sales to meet it are reported. One company reports having greatly increased its advertising and selling efforts since early in the year, so that it has been difficult to get a true picture of the market situation. However, the company unquestionably feels that there is a much healthier tone to the heating appliance business today than there was even two or three months ago.

Deliveries on all lines are prompt. Prices have been materially reduced since the peak of 1920 and are fairly well stabilized at the present time with no further reductions probable. Under present conditions it is very difficult for manufacturers to gage future requirements or make provisions for it, although some companies have been accumulating stocks in the belief that the holiday demand could not be met in any other way. The reason for this is that the dealer has been cautious and has awaited the consumer demand to start before ordering heavily, and the jobber does likewise with no buffer stock that should normally exist between consumer and manufacturer. Fads have largely entered into the sale of electrical appliances. Bobbed hair has greatly stimulated the sale of electric curling irons, the high price of coal has helped the sale of electric heaters, and business on electric percolators has been stimulated.

In general the present situation is very favorable to the electrical appliance manufacturers. It is notable that several small manufacturers who attempted to get into the heating appliance game and were trying to disturb prices have gone out of business. The expiration of the Marsh license patents was the incentive that led a considerable number of small heating appliance manufacturers to start up without a great deal of capital and with less experience, and while they have to some extent temporarily upset prices, it is believed that the condition is rapidly adjusting itself to the proper level.

Good Sales Reported by Two Manufacturers

"THE best month's business in nineteen years" is the way A. F. Wakefield, vice-president the F. W. Wakefield Brass Company of Vermilion, Ohio, describes the October sales report. "Although the final figures for October are not yet available, we have already topped the largest previous single month's business this company has ever done since its organization in 1905. The slump which many complained of during the summer, and which we felt most acutely as long ago as last June, seems to have definitely passed. Inquiries, specifications and actual orders both for immediate installation and for distributors' stocks," says Mr. Wakefield, "have been increasing steadily and show every indication of continuing through the season in normal volume." Sales of electric vibrators have also been heavier in 1924 than during any year in the history of the P. A. Geier Company, according to F. J. Bottron, general manager.

Steadily Increasing Demand for Electrical Sheets

THERE is a steadily increasing demand for electrical sheets coming from practically all lines in the industry, including makers of motors and generators for automobiles. However, there appears to be a strong tendency to hold back orders until the steel is actually required, and doubtless this attitude has been encouraged by the slackness in steel demand, which has made it possible to obtain very good deliveries. Manufacturers believe that when business again gets above the average it may be difficult to get steel as promptly as it is required. Warehouses find that the present movement of electrical sheets is small, but this is usually the case when the manufacturers are able to make good deliveries.

Within the last four months some price revisions were made downward, but prices are now fairly steady, and

as the steel industry is gradually improving any price revisions are likely to be upward. Manufacturers report that at the present prices the margin of profit is very small. Deliveries have been good as shipping facilities are of the best and mills have been eager for orders and of course can manufacture and ship with great promptness. The future demand will follow the improvement of general business, signs of which are at present evident.

Non-Ferrous Metal Demand Good —Prices Continue Advance

THE demand for all the more important non-ferrous metals has been good during the week both from here and abroad. Copper has again advanced to the level of early September, some lead has sold as high as 9 cents, zinc has been active and tin sales were good. Copper has been in good demand, and producers feel that the advance in prices is not liable to be followed by another reaction. The brass companies report good orders, and one large interest especially has assured business for the next two months in lines that have not been especially active lately. Very good foreign business has also been secured.

NEW YORK METAL MARKET PRICES

	Oct. 22, 1924 Cents per Pound	Oct. 29, 1924 Cents per Pound
Copper, electrolytic	13¼	13.55
Lead, Am. S. & R. price	8½	8.65
Antimony	11⅜–11½	11½
Nickel, ingot	29–30	29–30
Zinc, spot	6¼	6.85
Tin, Straits	51⅛	52¼
Aluminum, 98 to 99 per cent	28	28

The official contract price of the American Smelting & Refining Company for lead has made three advances since Thursday of last week, the last being on Monday, when the present level of 8.65 cents was established. The rapid advance in price stirred up many orders which producers were not able to fill so that some lead was sold by speculators for 9 cents, although no large amounts were taken at that level. Conditions in lead-consuming industries are not greatly changed, but are somewhat improved.

Zinc has been in good demand both for domestic use and for export, with somewhat better prices being obtained for export. Galvanizers were the principal buyers in the American market. The tin market has been active, although the demand has been almost entirely for prompt shipment. Stocks of the metal are being depleted, but production is capable of being expanded.

Trade in New England Exhibits Pre-Election Lull

BUSINESS hesitated slightly this week in the New England district pending election developments, but total sales of supplies hold up extremely well. The Lynn works of the General Electric Company received an order from the city of Chicago for 6,500 ornamental street-lighting units, representing over half a million dollars' worth of business and the beginning of an installation estimated to cost about four million dollars when completed. Apparatus sales were featureless, although there is some buying of generating machinery in the paper industry. One of the larger New England central-station companies is reported still in the market for a 45,000-kw. steam turbine unit.

Jobbers report increasing activity in the sale of radio apparatus, domestic lighting fixtures and wire. Appliances are selling well, the total bookings of twelve central stations last week being $10,086, the major items covered being thirty-six cleaners, seventy irons, seventy-seven portable lamps, twenty-four kitchen units, sixteen toasters and twenty-nine washers. Prices of rigid conduit and fittings fell off approximately 4 per cent; flexible armored conductor is a bit easier, and sheet brass, seamless tubes and sheet copper stiffened ¼ cent per pound. Outside pole-line construction material is very active, but sales of underground conduit are quieter.

Middle Western Business Stable but Cautious

BUSINESS has been rather quiet in the Middle Western territory, although the volume was good. However, the general tone of the market seemed a trifle cautious, as if the industry were waiting on a settlement of the political situation. Few orders of magnitude were placed, but one copper producer reported receiving an order for 110,000 lb. from a St. Louis manufacturer. The demand for poles was active, one utility placing an order for seventy-three carloads for future delivery at the prevailing market price. Construction work continues with the utilities and the amount of work planned is assuming considerable proportions. The Illinois Power & Light Corporation, it is reported, intends to spend several million dollars in expansion work in Illinois and Iowa. Reports from the railroads show that the carloadings are increasing, indicating the Middle West is buying varied commodities in greater quantities.

Prices in general remain firm, with the exception of conduit, which dropped approximately 4 per cent. There is no apparent reason for this reduction at this time. It is felt among most distributors and certain jobbers that this reduction is unfortunate, coming at this time, as it is apt to retard purchasing generally of this commodity throughout the industry. One manufacturer, however, reduced the price, forcing the others to follow suit. A revision has also been made in the price of street-lighting equipment.

Central-Station Purchases Good in the New York District

GENERAL purchases by central stations have been showing an improvement in the last few weeks. Major apparatus is not moving as well as last year, but miscellaneous-equipment sales are good, much transmission-line equipment being purchased. At present the purchase of major apparatus is estimated at about 20 per cent under last year. This is in line with the normal trend. Not only is purchasing of auxiliary apparatus now good, but there are very good prospects for such equipment, including feeder voltage regulators, power transformers, substation equipment, etc.

Contracts have just been closed with three companies by a Pennsylvania central station for complete pole requirements to June, 1925. These contracts total about $110,000. Recent sales in this district also include $150,000 worth of stokers to an Ohio utility; $350,000 worth of miscellaneous equipment, including power transformers, high-tension insulators and lightning arresters to a Georgia utility and two 25,000-kw. waterwheel generators to a Pennsylvania development.

Sales of supplies by jobbers have been steadily increasing. Reports by various jobbers place this increase at from 15 per cent to 25 per cent above August sales. General commodities and appliances are said to be moving best. It is believed that the increase in appliance sales is largely accounted for by the extensive advertising conducted by manufacturers. Prices are holding firm with the exception of conduit, which has decreased approximately 4 per cent. Stocks are in general good, and lamp sales are steadily increasing.

Industrial Purchasing Good on the Pacific Coast

INDUSTRIAL business is good on the Pacific Coast. Although individual sales are small, in the aggregate sales are large. This general condition apparently is the justification of the constructive work of various communities in attracting factories. Power company and railroad orders are largely for maintenance purposes and will probably remain so until next year. It is hoped that present rains will speedily lift the power restrictions in southern California and pave the way for a vigorous holiday campaign on appliances. Jobbers' advance orders are perhaps a little under those of last year, but a good though late season is expected and heavy reorders are predicted in that section. In other sections of the Pacific Coast appliances are moving well and a very good holiday trade is anticipated.

Sizable supply orders are scarce just now, but this is usual near the end of the month. Electrical retail business has improved since the recent rains. An order for three carloads of conduit has been reported for Los Angeles, with the market somewhat weaker. An order for several thousand dollars' worth of telephones, wire and pole-line hardware, for export to the Philippines, has also been closed. Renewed interest in intercommunicating telephones is noticeable. Deliveries have greatly improved and are good. Prices have remained practically constant.

Satisfactory Sales in Southeast— Textile Situation Improving

MANUFACTURERS' representatives and jobbers report a continuation of satisfactory business, one of the leading jobbers in Atlanta stating that his business in October has been $50,000 in excess of the same month last year. The general senti-

ment expressed at the recent Southern Textile Exposition at Greenville, S. C., was that the mills in the Southeast are in good shape and that the prospects are bright for a resumption of satisfactory activities. The impression obtained by electrical interests at this exposition was that a number of electrifications will result from the improved sentiments. Orders from this class of purchaser are already in hand for a satisfactory amount of electrical equipment. The new plant of the Louisiana Power & Light Company at Sterlington, La., will open up a field for the sale of electrical apparatus that has heretofore been untouched. There has been a noticeable drift toward the use of synchronous apparatus in the large motor applications in the territories supplied by the large Southeastern power companies.

Wiring devices are reported somewhat slow, industrial lighting equipment is in excellent demand, and commercial fixtures and lamps are moving even better than was anticipated earlier in the fall, this probably being a result of increased interest in lighting practice. Porcelain prices remain badly upset, and as a result the movement in this line is slow.

Activities of the Trade

General Electric Constructing Annex to Research Laboratories

Construction work has started on a new building in the Schenectady works of the General Electric Company, which will be used as an annex to the research and general engineering laboratories for the manufacture of vacuum tubes. This extension to the plant will have 115,000 sq.ft. of floor space. It will be of reinforced concrete, 80 ft. x 255 ft., five stories high, with a one-story annex, 100 ft. x 150 ft. The annex will contain electrical testing apparatus used by the general engineering and research laboratories.

Westinghouse Sells Equipment to Columbus Power & Electric

Electrical equipment amounting to more than a third of a million dollars has been ordered from the Westinghouse Electric & Manufacturing Company by the Columbus Electric Power Company to equip its new Bartlett's Ferry station. The equipment consists of two 18,750-kva., 12,000-volt, 150-r.p.m. vertical waterwheel generators with directly connected exciters. To step up the generator voltage to the line voltage of 114,200 seven 6,250-kva., single-phase, water-cooled transformers are being built.

Other equipment includes seven 12,000-volt indoor-type and five 115,000-volt outdoor-type oil circuit breakers, both electrically operated. In addition, 115,000-volt outdoor-type metering equipment has been ordered.

Standard Electric Stove Company Holds Sales Convention at Toledo

A very enthusiastic sales convention of the salesmen and distributors of the Standard Electric Stove Company was held in Toledo on October 10 and 11. Among those in attendance were Mr. Lenihan of the Revere Electric Company, Chicago; Mr. Van Aernam of the Iron City Electric Company, Pittsburgh; Mr. Denison of Ogden & Denison, New York; Mr. Williams of the Post-Glover Electric Company, Cincinnati, and Mr. Bagnall of the A. T. Knowlson Company, Detroit.

C. A. Pierson, general manager of the Standard Electric Stove Company, says that the business of the company has shown a good growth during the present year and that reports from distributors and salesmen point to a good year in 1925.

Fairbanks, Morse Reports Decrease in Earnings for Third Quarter

Fairbanks, Morse & Company for the nine months ended September 30, 1924, reports a net income of $1,384,517, after charges, depreciation and federal taxes have been deducted. This compares with $2,094,977 before the deduction of federal taxes for the same period of 1923. Net income for the third quarter of this year was $404,977 and compares with $648,117 in the same quarter of the previous year.

Freed-Eisemann Corporation Sales Show Large Increase

Net earnings of the Freed-Eisemann Radio Corporation for the first nine months of 1924 were $1,246,897, according to the figures released in connection with the offering of 75,000 shares of common stock of the company. Gross sales for the first nine months of the year were $2,880,286, which compares with gross sales of $979,028 for all of 1923. Application for more than 200,000 shares was said to have been received by the bankers. It is understood that a request will be made to list the shares on the New York Curb Market.

Stoker Manufacturers' Association Issues Condensed Catalog

The Stoker Manufacturers' Association, W. V. McAllister secretary, foot of Walker Avenue, Detroit, has issued a condensed catalog of mechanical stokers which is a complete catalog of the various competitive manufacturers of this apparatus. The catalog is an example of the possibilities in co-operative advertising for competitive companies.

The association is composed of the following members: American Engineering Company, Philadelphia; Babcock & Wilcox Company, New York; Burke Furnace Company, Chicago; Combustion Engineering Corporation, New York; Detroit Stoker Company, Detroit; Green Engineering Company, Chicago; Illinois Stoker Company, Alton, Ill.; Laclede Stoker Company, St. Louis; Sanford Riley Stoker Company, Worcester, Mass.; B. F. Sturtevant Company, Boston; United Machine & Manufacturing Company, Canton, Ohio, and the Westinghouse Electric & Manufacturing Company, Philadelphia.

General Electric Company Receives Large Orders

The General Electric Company has received from the city of Chicago an order for 6,500 ornamental "Novalux" street-lighting units, sufficient to illuminate 125 miles of street. The order, believed to be the largest street-lighting contract ever placed by any city in the country, calls for concrete octagonal poles 12 ft. high, with 250-cp. "Mazda" lamps in alabaster rippled globes. The order amounts to more than $500,000, which is provided for out of a recent four-million-dollar bond issue, and calls for completion of the work by January 31, 1925.

The General Electric has also been awarded a contract by the Interborough Rapid Transit Company for the motors and control equipment for 150 new steel subway cars.

Manhattan Electrical Supply Profits Increase

The Manhattan Electrical Supply Company, New York, has reported a net profit of $138,958, after deducting expenses, taxes and depreciation, for the first nine months of 1924. This compares with $134,600 for the same period of last year. The net profit for the third quarter of this year was $27,585, as against $20,434 for the same quarter last year.

Allis-Chalmers Earnings for Third Quarter Show Increase

The quarterly earnings statement of the Allis-Chalmers Manufacturing Company for the quarter ended September 30 show billings to be $6,926,328, which compares with $6,865,443 for the corresponding quarter of 1923. The net profit for the same quarter of 1924 is reported as $824,561, as against $756,981 for the same period in 1923, after provision for federal taxes in both cases. The unfilled orders on hand as of September 30 amount to $10,376,527.

Both billings and earnings for the nine-month period of 1924 are in excess of the same period of 1923, the billing having aggregated $20,655,925, as compared with $18,169,205 for the similar period the year before—an increase of $2,486,719, or 13.69 per cent. The net earnings in the current nine-month period, after full reservation for federal taxes and other possible contingencies, are $2,412,165 and compare with $1,854,089 in 1923, an increase of $558,076 or 30.1 per cent. The total amount necessary for the entire year for both preferred and common stock dividends (figuring the latter at $4 per share) is

$2,185,639, so that to date there has been earned an excess of $? per share on the common.

Hubbard & Company, Pittsburgh, manufacturer of pole-line hardware, etc., has instituted a group insurance plan at its three Pittsburgh plants to the extent of $1,000,000, and affecting 800 employees. One hundred and eighty thousand dollars of the total amount was issued without cost to ninety employees whose period of service with the company covers fifteen years or more. On the balance the workers and the company pay the premium jointly.

The Link-Belt Company, 910 South Michigan Avenue, Chicago, has been awarded a contract by the Westinghouse Air Brake Company for material-handling equipment, in connection with the new foundry at Wilmerding, Pa., which will permit the employment of a continuous molding process.

The Railway & Industrial Engineering Company, Greensburg, Pa., manufacturer of transmission, switching and protective equipment, announces that it has recently opened a district office under the management of John H. Kuhns at 415 Swetland Building, Cleveland. This office will serve the entire state of Ohio and some sections of West Virginia and Michigan. Mr. Kuhns has been associated with the company since 1919 except for a short interval and prior to that was with the Westinghouse Electric & Manufacturing Company at Detroit and Toledo.

The Lighting Equipment Company, 339 South Wabash Avenue, Chicago, has been recently incorporated, with a capital stock of $40,000, for the manufacture and distribution of electric lighting equipment. R. W. Taylor, formerly with the Lightolier Company, New York, is president; M. W. Grove is secretary and J. H. Proulx is treasurer.

The Griscom-Russell Company, 90 West Street, New York has sold to the Public Service Electric Power Company, Newark, N. J., fifteen stage heaters for use in its new Kearny station. This station will also be equipped with Griscom-Russell "Multiwhirl" oil coolers for turbine bearings and "U-fin" air coolers for generator windings.

The Alaska Freezer Machine Company, Winchendon, Mass., is placing on the market a 1-gal. ice-cream freezer, known as the "Pioneer" and made by the Louisville Electric Manufacturing Company, Louisville, Ky. It is operated from a lamp socket and is driven through a worm-gear by a universal ⅛-hp. General Electric motor.

The Emerson Radio & Phonograph Corporation, 309 Sixth Avenue, New York, has been chartered at Albany with a capital of $1,000,000 in shares of $5. This represents a consolidation of the Emerson Radio Corporation and the Emerson Phonograph Company, Inc. Benjamin Abrams, Max Abrams, and Louis Abrams are the directors.

The International General Electric Company has received an order for complete electrical equipment for an extension to the San Martin sugar mill at Tabacal, Argentina. One plant is already well electrified, but the use of electricity will now be extended to driving the rolls. The order includes two 1,250-kw. variable-speed turbo-generators, seven 300-hp. variable-speed induction motors, switchboard, control apparatus and auxiliary motors.

The Roller-Smith Company, 233 Broadway, New York, manufacturer of electrical instruments and circuit breakers, announces the appointment of Charles R. Speaker, Evening Star Building, Washington, D. C., as its representative in the District of Columbia. Mr. Speaker will also handle the Roller-Smith Company's government business in Maryland, Virginia, North Carolina and South Carolina.

The Canadian Westinghouse Company, Ltd., Hamilton, Ontario, Canada, has recently installed in its plant what is said to be one of the largest boring mills ever built, this tool being necessary in order to handle the very large generators now being built by the company. The mill has a swing of 36 ft. 2 in. and will take work 12 ft. in height. The boring bars have a vertical travel of 8 ft., and the diameter of the table is 8 ft.

C. Brandes, Inc., 237 Lafayette Street, New York, manufacturer of radio apparatus, has filed a certificate in the office of the Secretary of State at Albany increasing its capital stock from $1,000,000 to $2,500,000.

New Equipment Available

Current Transformer

A new instrument current transformer, with an auxiliary circuit, that automatically compensates for ratio and phase-angle errors, has been devised by the General Electric Company for use by central stations where high metering accuracy is desired in connection with the measurement of energy distributed to customers. The instrument is of the wound type, rated at 4,500 volts, with current ratings up to 600 amp.

Cylinder-Unit Electric Furnace

An electric hardening furnace of the cylinder-unit type has been brought out by the Eaton Electric Furnace Company, Taunton, Mass., to enable extreme simplicity of assembly to be obtained, with maximum convenience in replacing heating coils. The furnace is known as the company's "Model J" and has a full-load rating of 14 kw. The interior construction includes firebrick in three sections surrounded by 6 in. of insulation. A removable insulated plug in the back of the furnace is held in place by three locking levers, giving quick and easy access to a carborundum cylinder unit, on the outside of which removable resistance coils are wound. The loading shelf or floor of the furnace is also of carborundum and is removable. In front of the cylinder unit a recess is provided in the firebrick where powdered charcoal may be placed to deoxidize the furnace chamber. The furnace chamber is 9 in. wide, 15 in. deep and 7 in. high, and the weight of the furnace is 1,350 lb.

High-Strength Copper Alloy Cable

A copper-alloy cable that possesses high electrical conductivity, high tensile strength and non-corrodibility has been placed on the market by the Bridgeport Brass Company, Bridgeport, Conn. It is composed of an inner core consisting of seven strands of "Phono-Hi-Strength" wire each 0.110 in. in diameter and having a tensile strength of 130,000 lb. per square inch, surrounded by twelve strands of 0.110-in. diameter hard-drawn copper. Proof loads of 12,000 lb. have been carried for over twelve hours before fracture occurred. This cable has been developed primarily for use in connection with trunk-line railway electrification.

Heat Exchanger

A heat exchanger for oil refinery use consisting of two short exchangers connected by a flexible bend and shell cover, which provides what is said to be a compact, rugged, readily portable and easily installed unit that is approximately half the length of a single unit designed for equivalent duty, has been developed by the Griscom-Russell Company, 90 West Street, New York. In this exchanger the cooling liquid and the liquid to be heated flow in opposite directions. Two styles of baffles are used to guide the liquid around the tubes, the selection depending upon the allowable pressure loss in the shell. They are known as the "Twin Multiwhirl" and "Twin Vaneflo" exchangers. All oil connections are at the same end to simplify piping, and floating heads and head covers are provided. The twin arrangement also divides the tube and shell expansion between two units.

Glue Pot. — A dry-type glue pot equipped with rheostatic control has been placed on the market by the Westinghouse Electric & Manufacturing Company. This new device gives a wide range of heat control and is portable, the rheostat being separate so that it can be laid on a bench or hung on a wall. The casing and bottom plate are said to be made of heavy sheet steel and the removable glue vessel of heavy spun copper.

Traffic Signal.—A traffic signal designed to regulate both wheel traffic and pedestrian has been developed by the Universal Signal Company, New London, Conn. The signal is electrically operated by lighted, colored, lettered signs whereby the moving public can read, in print and color, the orders under which they can proceed. Twenty-one orders are said to be at the command of the traffic officer by the manipulation of four levers at the curb, or from any other suitable point.

New Trade Literature

LIGHTING UNITS.—The F. W. Wakefield Brass Company, Vermilion, Ohio, is distributing an elaborately illustrated portfolio entitled "How To," which describes and visualizes the exact steps in the successful kitchen-lighting campaign.

ELECTRIC FURNACE. — The Detroit Electric Furnace Company, 2331 First National Bank Building, Detroit, has issued a catalog entitled "Speedier Production—Better Brass," which describes the advantages of its electric brass furnaces, giving performances and results. The catalog contains illustrations showing typical installations melting from 500 lb. to 50,000 lb. daily.

HIGH-FREQUENCY INDUCTION FURNACES.—A circular describing its high-frequency induction furnaces for the commercial melting of ferrous and non-ferrous alloys has just been issued by the Ajax Electrothermic Corporation, Trenton, N. J. Illustrations showing the various types of furnaces and the names of some of the companies using them are included.

COPPER CABLES. — The Rome Wire Company, Rome, N. Y., has issued a pamphlet describing the "Rome" bare copper cables. It also contains illustrations showing its mill in 1905 and the works in 1923 and gives a short sketch of the growth of the company in eighteen years.

ELECTRICAL IRON AND STEEL.—"Iron and Steel for Electrical Uses" is the title of a fifty-six-page booklet issued by the American Rolling Company, Middletown, Ohio. This booklet covers the history, manufacture and magnetic properties of "Armco" electrical sheet steels and "Armco-Ingot" iron. Several tables are included, as well as typical core-loss curves, normal induction curves, hysteresis curves, etc.

METERING METHODS.—"Modern Metering Methods" is the title of a booklet issued by the Superior Switchboard & Devices Company, Canton, Ohio. It is a handbook on meter installations, testing and laboratory methods, and gives instructions for installing metal meter devices, meter test switches, meter test locks and the necessary equipment and accessories for making installations.

TRAFFIC CONTROL. — The Reynolds Electric Company, 2650 West Congress Street, Chicago, is distributing bulletin No. 401, describing the "Reco" traffic controls for "stop and go" signals.

TIME-LIMIT CONTROLLER.—The Cutler-Hammer Manufacturing Company, Milwaukee, has issued a new publication, known as C-2, in which it describes the "C-H" inductive time-limit controller, a new device recently developed by the company for steel-mill service.

STEAM TRAP.—Bulletin A, issued by the Armstrong Machine Works, Three Rivers, Mich., describes the "Armstrong" steam trap with steel body for high pressure and superheat.

PUSH-BUTTON SWITCHES.—The Bryant Electric Company, Bridgeport, Conn., is distributing a folder calling attention to the "Bryant" new "55-Hundred Line" of push-button switches.

STREET-LIGHTING TRANSFORMERS.—The General Electric Company, Schenectady, N. Y., has issued bulletin No. 45,124, entitled "Street-Lighting Transformers," which describes and illustrates the "General Electric" constant-current transformers, both indoor and outdoor and for pole or subway mounting, individual lamp series transformers, cut-outs, transformer controls and protective devices. A table of transformer capacities is included.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

An agency is desired in Singapore, Straits Settlements (No. 11,994), for electric automobiles.

An agency is desired in Johannesburg, South Africa (No. 11,979), for electrical appliances.

An agency is desired in Calgary, Alberta, Canada (No. 11,990), for electrical equipment.

Purchase and agency is desired in Melbourne, Australia (No. 11,999), for electrical indicating and recording instruments, pyrometers, etc.

An agency is desired in Kimberly, South Africa (No. 11,998), for radio equipment.

Purchase or agency is desired in Manchester, England (No. 11,955), for vacuum cleaners.

ELECTRIC GENERATING UNIT FOR A POWER STATION IN SPAIN.—Bids will be received until Dec. 12 for furnishing and installing an electric generating unit in a power station in Spain, according to reports from James G. Burke, assistant trade commissioner at Madrid. No further technical details are available. The address can be secured from the Electrical Equipment Division, Bureau of Foreign and Domestic Commerce, Washington, D. C.

SUBURBAN RAILWAYS AROUND CAPE TOWN, SOUTH AFRICA, TO BE ELECTRIFIED—Consul General D. C. Poole, Cape Town, South Africa, reports that the Minister of Railways and Harbors, Cape Town, has announced that steps have been taken to obtain tenders for the erection of a power station, substations, transmission lines, etc., in connection with a plan to electrify the suburban lines in and about Cape Town. Tender forms have not yet been issued, but this will be done through the High Commission for South Africa, Trafalgar Square, London, England.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

BOSTON, MASS.—Work will soon begin on a two-story power plant, 70 ft. x 75 ft., for the Gillette Safety Razor Company, 41 West First Street, South Boston, for which Charles T. Main, 200 Devonshire Street, is engineer.

PEABODY, MASS.—The American Glue Company contemplates the installation of electric power equipment in connection with the proposed rebuilding of its local plant, recently damaged by fire, with loss of about $50,000.

Middle Atlantic States

CANISTEO, N. Y.—The New York Central Electric Corporation, Perry, has acquired the local system of the Distributors' Electric Company and will furnish service here in the future. Plans are under consideration for extensions and improvements in the local system, as well as transmission-line additions.

MACHIAS, N. Y.—The Niagara, Lockport & Ontario Power Company, Buffalo, contemplates the installation of lighting systems in Machias, Lime Lake and Machias Junction.

NEWBURGH, N. Y.—Steps have been taken to secure an ornamental lighting system on Mill Street, from the Quassaick Bridge to Broadway.

RANSOMVILLE, N. Y.—Extensions and improvements are contemplated to the street-lighting system. The service is furnished by the Lewiston & Lake Ontario Shore Power Company, Lewiston.

READING, N. Y.—The Public Service Commission has authorized the New York Central Electric Corporation, Ithaca, to erect a transmission line into the town of Reading and to supply electricity here.

STATEN ISLAND, N. Y.—Bids will be received by the Superintendent of Lighthouses, Staten Island, until Nov. 19 for copper, batteries and wire, oil engines, gasoline engines, storage batteries, clocks, time markers, instruments, etc.

WAYLAND, N. Y.—The New York Central Electric Corporation, Ithaca, has been granted permission to erect a transmission line (but not for distribution purposes) in the town of Wayland.

WILLARD, N. Y. — The Board of Trustees has awarded a contract to the New York Central Electric Corporation, Ithaca, for the installation of a street-lighting system here.

IRVINGTON, N. J.—The Public Service Transportation Company, Newark, plans to install electric power equipment in connection with the establishment of its motor-bus maintenance and repair works at the former plant of the Day-Elders Motor Corporation, Twenty-first and Coit Streets, to cost about $55,000.

ALTOONA, PA.—Arrangements are being made to serve the communities in the Bedford County part of Morrison's Cove with electricity. The current will be furnished by the transmission line of the Penn Central Light & Power Company, Altoona, which extends from the Saxton power plant to a point at Summit, connecting with the lines leading to Altoona. Local companies are being organized in Woodbury and at Waterside, and other communities will organize at an early date to install and operate distribution systems.

BRISTOL, PA.—The City Council has approved plans for the installation of an improved street-lighting system on Mill Street, in the business district.

CORRY, PA. — The City Council has awarded a contract to the Venango Public Service Company, Corry, for extensions to the ornamental street-lighting system, to cost about $20,000.

PHILADELPHIA, PA.—Plans for the proposed plant of the Publicker Commercial Alcohol Company, Swanson Street and Snyder Avenue, to be located at Delaware Avenue and Bigler Street, include a power plant. The cost of the project is estimated at $2,000,000. Clarence E. Wunder, 1520 Locust Street, is architect.

SHARON, PA.—Extensions to the ornamental lighting system on River Avenue, to cost about $10,000, is under consideration by the City Council.

BALTIMORE, MD. — Bids will be received by the Board of Awards of Baltimore City, Public Improvement Commission, 517 Hearst Tower Building, until Nov. 5 for furnishing and installing electric wiring for clocks in the Forest Park Sennior-Junior High School. H. G. Perring is supervising engineer.

CUMBERLAND, MD.—The installation of an ornamental lighting system on North Mechanic Street in the business section is under consideration.

FREDERICKSBURG, VA.—The Spotsylvania Power Company is planning extensions to its transmission lines in this section.

NORFOLK, VA.—The Ford Motor Company, Detroit, has authorized the complete electrification of its local assembling plant in the Newton Park section, now under construction, to cost about $1,000,000. The cost of the electrical installation is estimated at $100,000. Hitt & Brown, 137 West Charlotte Street, Norfolk, are in charge of the electrical work.

WASHINGTON, D. C.—Bids will be received by the General Purchasing Officer, Panama Canal, until Nov. 14, for electric storage batteries, etc. (Circular 1637).

WASHINGTON, D. C.—Bids will be received by the Chief of Air Service, United States Army, until Nov. 4, for 10 aircraft storage batteries (Circular QQR-38).

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, until Nov. 4, for 35,000 ft. of electric cable, for service at the Philadelphia yard (Schedule 2808).

WASHINGTON, D. C.—Bids will be received by the Chief of Engineers, United States Army, until Nov. 14, for 10,000 ft. of two-conductor lead-covered and armored electric cable (Proposal 7).

North Central States

GRAND LEDGE, MICH.—The installation of an ornamental lighting system in the business district is under consideration by the City Council. The present plant provide for 100 lamps, to cost from $7,500 to $10,000. The Consumers' Power Company, Jackson, furnishes street-lighting service here.

ASHLAND, OHIO.—The installation of a new street-lighting system throughout the city is under consideration. The plans provide for extension to the ornamental lighting system and for replacing the present five-lamp clusters for standards carrying single lamps of high candlepower. In addition to the ornamental lamps, the plans provide for the installation of 150 lamps of 400 cp., 300 lamps of 250 cp. and 190 lamps of 100 cp.

CLEVELAND, OHIO.—Bids will be received at the office of the Commissioner of

Purchases and Supplies, City Hall, until Nov. 7, for fiber conduit for the division of light and power.

CLEVELAND, OHIO.—Bids will be received at the office of the Commissioner of Purchases and Supplies, City Hall, until Nov. 7, for electric meters for the division of light and power.

HAZARD, KY. — The Kentucky-West Virginia Power Company contemplates the erection of a 132,000-volt transmission line from Vicco on Carr's Fork through the Carr's Fork headwaters and Beaver Creek to the Big Sandy Valley.

BLUFFTON, IND.—The property of the Marion & Bluffton Traction Company and the Linn (Ind.) Grove Light & Power Company have been acquired by the Midland Utilities Company. Extensions in transmission system are under consideration.

LEESBURG, IND.—The Interstate Public Service Company, Indianapolis, has secured permission to acquire the electric system of the Leesburg Electric Light & Water Company. Transmission-line and other extensions are contemplated in this district.

MADISON, IND.—The City Council has adopted a resolution for the installation of a new lighting system on Main Street, from Walnut Street to Broadway, to be maintained by underground wires. The lamps will be installed by the Madison Light & Power Company.

DE KALB, ILL.—The Illinois Commerce Commission has granted the Illinois Power Company, Springfield, permission to erect a transmission line from De Kalb to Cortland, Maple Park and Elburn, and to supply electricity in the three villages.

ALGOMA, WIS. — The City Council is considering the installation of a street-lighting system for the north end of Buchannan Street, which is at present without street lamps.

CEDARBURG, WIS.—The installation of one or two 450-hp. oil engines in the municipal electric light plant is under consideration by the Municipal Electric Light Commission.

GREEN BAY, WIS. — Plans are being prepared by the Wisconsin Public Service Corporation for the construction of a fourth hydro-electric plant at the Sandstone site on the Peshtigo River, near Crivitz.

PARKS FALLS, WIS.—The Flambeau Paper Company has plans under way for the construction of a dam in this vicinity, in connection with a proposed hydro-electric development. Mead & Seastone, 115 South Carroll Street, Madison, are engineers.

PLATTEVILLE, WIS. — The Interstate Light & Power Company, Galena, Ill., is considering the erection of a transmission system in the field of mining camps, to cost about $50,000.

LITTLE FALLS, MINN.—The Minnesota Power & Light Company, Duluth, contemplates increasing the output of its hydro-electric power plant at Blundian Rapids, now nearing completion, from 16,000 hp. to 25,000 hp. Work is in progress on a 110,-000-volt transmission line from the new plant to Nashwauk.

CENTERVILLE, IOWA. — The Iowa Southern Utilities Company has been authorized to erect and operate a 44,000-volt transmission line between Grinnell and Newton, and also to build a 6,600-volt line from Reasnor to a point near Sully, where it will connect with another line of the Company.

ST. LOUIS, MO.—An appropriation of $100,000 for the installation of new electric street lamps has been approved by the Citizens' Bond Issue Supervisory Committee. Lamps will be installed on approximately 13 miles of streets, of which about 8 miles of this territory has never before been lighted. About 5 miles formerly had gas lamps, which were torn out in order that street improvements could be made. James A. Hooke is director of public utilities.

MOBRIDGE, S. D.—Preliminary plans are under way for extensions and improvements in the system of the Mobridge Electric Company, recently acquired by new interests.

RAYMOND, S. D.—The Northwestern Public Service Corporation, Armour, has acquired property of the Spink County Power Company, operating in this district, and plans extensions to the system. Service will be furnished in Ashton, Athol, Northville, Frankford, Mellette, Brentford and vicinity.

SALEM, NEB.—The Council plans to erect a transmission line to Falls City, to secure electricity for local light and power service. A substation and distributing system will be installed.

WAKEENEY, KAN.—The Central Kansas Power Company, Gypsum, is negotiating for the purchase of the municipal electric plant. Extensions and improvements are contemplated if the plant is taken over.

Southern States

CONETOE, N. C.—The Board of Town Commissioners has authorized an issue of $10,000 in bonds for the installation of a municipal electric light plant. The erection of a transmission line to the town of Tarboro to secure electricity to operate the system is under consideration.

ELLENBORO, N. C.—The Council is considering calling an election to vote on the proposal to issue $10,000 in bonds to establish a municipal electric lighting system.

EASLEY, S. C.—The Easley Rural Electric Line, recently chartered, contemplates the erection of a transmission line to George's Creek, also to Tripps, a distance of about 10 miles.

COCONUT GROVE, FLA.—Bids will be received by the Mayor and Board of Aldermen until Nov. 24 for the construction of waterworks, including power and pumping station, electric generating machinery, motor-driven centrifugal pumps and compressors, etc. The Main Engineering Company, Daytona, is engineer.

TAMPA, FLA.—Plans are under way by the South Tampa Electric Company, a subsidiary of the United States Export Chemical Corporation, fertilizer manufacturer, for the construction of an electric plant on Ruskin Road, north of the Alafia River. The equipment will include Diesel engines of 750-hp. capacity. The cost is estimated at $90,000.

LITTLE ROCK, ARK.—The Arkansas Central Power Company plans to build an automatic substation at 402 West Twenty-third Street, to cost about $28,000.

MAMMOTH SPRINGS, ARK.—The Central Power & Light Company, Chemical Building, St. Louis, which recently acquired the property of the Mammoth Springs Electric Light & Power Company, it is reported, contemplates an expenditure of about $1,-000,000 for improvements to the properties and extensions of transmission lines. The work will include the reconstruction of Dam No. 2 on Spring River and a new dam below Dam No. 3. Transmission lines will be extended to Hoxie, Walnut Ridge and Willow Springs.

STERLINGTON, LA.—Preliminary plans are being prepared by Ford, Bacon & Davis, 115 Broadway, New York City, for a large electric plant at Sterlington for the Arkansas Light & Power Company, Pine Bluff, Ark.

BLACKWELL, OKLA. — Preliminary plans are being made by R. W. Porter for an electric light and power plant and ice factory in Blackwell.

SENTINEL, OKLA.—The Inland Utilities Company, Kansas City, Mo., has applied for a franchise to install an electric light and power service in Sentinel.

COOPER, TEX.—The Texas Power & Light Company, Dallas, has acquired the property of the Cooper Power, Light & Ice Company. The company has been granted a fifty-year franchise by the City Council to operate in Cooper.

DECATUR, TEX.—The citizens have voted to sell the municipal electric plant to the Texas Power & Light Company, Dallas, which will furnish electric service from its 60,000-volt transmission line in this district.

DILLEY, TEX.—The Council has plans under way for the installation of a municipal electric lighting plant in connection with an ice-manufacturing plant, pumping station, etc., to cost about $60,000. Terrell & Bartlett, Colcasieu Building, San Antonio, are engineers.

GILMER, TEX.—The East Texas Public Service Company, Marshall, plans to remodel the local electric plant, installing oil-burning equipment and other apparatus for use in emergencies. Regular service will be secured from the transmission line of the company from the Marshall plant.

HERMLEIGH, TEX.—The Snyder (Tex.) Utilities Company is erecting a transmission line from Snyder to Hermleigh, about 13 miles, to supply electric service here.

KEMP, TEX.—The local electric light and power plant, owned by L. A. Bauguss, was recently destroyed by fire. Plans are under way to rebuild the plant.

MARSHALL, TEX.—The East Texas Public Service Company is planning to erect 150 miles of transmission lines connecting Marshall with twenty-five East Texas towns. The cost is estimated at $225,000.

Pacific and Mountain States

EVERETT, WASH.—The Puget Sound Power & Light Company, Seattle, has applied to the Commissioners of Snohomish County for a franchise to erect and operate electric transmission lines in Snohomish County.

MORTON, WASH.—The Board of Public Works contemplates the installation of a municipal light and power system, electricity to be secured from transmission lines in this district.

NEWPORT, WASH. — The Mountain States Power Company, Sandpoint, Idaho, has submitted a proposal to the Council for improvements to the street-lighting system.

SEATTLE, WASH. — The Puget Sound Power & Light Company plans to build a substation at 2823 Hanford Street.

SEATTLE, WASH.—The City Council has adopted resolutions for the installation of an improved lighting system, using cast iron poles and brackets, on Fremont Street, in the business district.

EUGENE, ORE.—The Eugene-Springfield Land & Water Company contemplates the construction of a hydro-electric power plant in the vicinity of Clear and Fish Lakes, with an initial development of 50,-000 hp.

OAKRIDGE, ORE.—The construction of an electric plant, to develop 200 hp., in Oakridge, is under consideration. Water will be conveyed to the plant by a flume, 1½ miles long, from Salmon Creek.

FORT BRAGG, CAL.—Application has been filed with the Board of Mendocino County by Clyde W. Henry for a franchise to erect transmission lines in Round Valley to supply electricity for lamps, heaters and motors. Bids for the above franchise will be received until Nov. 1 at the court house, Ukiah.

GONZALES, CAL.—The Coast Valleys Gas & Electric Company, Salinas, has applied to the Railroad Commission for permission to acquire the local electric distribution system owned by the Nestle's Food Company. The electric company now supplies electricity to operate the system.

LOS ANGELES, CAL.—The Board of Public Works has approved specifications for an ornamental lighting system on Western Avenue, providing for 137 pressed-steel standards.

MERCED, CAL.—The Board of City Trustees has authorized plans for the installation of an ornamental lighting system on Twenty-third Street, between G and N Streets, using reinforced-concrete lighting standards.

LINGLE, WYO.—Work will soon be started on rebuilding the local electric light and power plant. It is proposed to double the present output of the power station.

Canada

VANCOUVER, B. C.—The City Council plans to install an improved street-lighting system on Granville Avenue, to cost about $24,000. C. H. Fletcher is city electrician in charge.

BRANTFORD, ONT.—The installation of a 1,000-kva. transformer in the substation of the Brantford Hydro-Electric System is under consideration.

GRIMSBY, ONT.—The Hydro-Electric Power Commission of Ontario, Toronto, contemplates erecting a substation and installing an electric distribution system in Grimsby, to cost from $30,000 to $60,000. F. A. Gaby is chief engineer.

KAPUSKASING, ONT.—The Spruce Falls Pulp & Paper Company is considering a hydro-electric development on the Matagami River at Smoky Falls, to cost about $5,-000,000 in connection with a paper mill. It is estimated that 200,000 hp. can be developed. The cost of the entire project is estimated at $10,000,000.

SARNIA, ONT.—The construction of a new substation is under consideration by the Sarnia Hydro-Electric System.

QUEBEC, QUE.—The Shawinigan Water & Power Company is negotiating for the purchase of the property of the Portneuf Hydro-Electric Company. If taken over, it is proposed to make extensions including additional transmission lines.

Electrical Patents

Announced by U. S. Patent Office

(Issued September 16, 1924)

1,509,006. ELECTRODE HOLDER; Earl B. Thomas, Atlantic City, N. J. App. filed Feb. 28, 1923. For low-voltage soldering.

1,509,007. DISCHARGING DEVICE FOR ELECTRIC FURNACES; Carl T. Thorssell and Ebbe C. Beck-Friis, Gothenburg, Sweden. App. filed June 20, 1921.

1,509,010. SIGNALING DEVICE; John M. Wenzel, Chicago, Ill. App. filed June 3, 1922. Door releasers for apartment houses.

1,509,042. ELECTRIC WATER HEATER; William M. R. Kay, Windsor, Ontario, Canada. App. filed Nov. 6, 1922. For domestic use.

1,509,049. REAR-END SIGNAL FOR VEHICLES; Charles F. Marston, Brooklyn, N. Y. App. filed June 1, 1920.

1,509,074. INSULATOR; James L. Wilson, Davenport, Iowa. App. filed April 6, 1921. Having wire held by a cover portion attached to body of insulator.

(Issued September 23, 1924)

1,509,096. PLUG CLUSTER; Reuben B. Benjamin, Chicago, Ill. App. filed July 30, 1920.

1,509,097. ELECTRIC HEATER; Wallace J. Bisset, Bloomsburg, Pa., and Morris S. Evans, Berwick, Pa. App. filed June 19, 1922.

1,509,101. PROCESS AND APPARATUS FOR COATING WIRE; Alan S. Dana, Seymour, Conn. App. filed Jan. 26, 1920.

1,509,102. ELECTRICAL CONDUCTOR; Alan S. Dana, Seymour, Conn. App. filed Jan. 26, 1920. With an electrodeposited lead sheath between the conductor and the insulation.

1,509,103. VAPOR DYNAMO-ELECTRIC MACHINE; William St. G. Elliott, Jr., New York, N. Y. App. filed Dec. 14, 1920. Wherein the energy of expanded vapor is converted directly into electrical energy without the use of moving parts.

1,509,114. CONTROL SYSTEM FOR ELECTRIC MOTORS; Leigh J. Stephenson, Chicago, Ill. App. filed July 20, 1921. For quickly reversing direction of rotation of electric motor embodying shunt-field winding.

1,509,138. ALKALINE ELECTRIC BATTERY; Leopold Grafenberg, Cologne-Lindenthal, Germany. App. filed May 21, 1923.

1,509,139. RADIO RECEIVING APPARATUS; David Grimes, Tompkinsville, N. Y. App. filed April 21, 1922. Using alternating current for heating the filaments.

1,509,140. ELECTRIC WATER HEATER; Ernest Groulx, Montreal, Quebec, Canada. App. filed May 26, 1923.

1,509,152. ELECTRODE FOR RIVET HEATERS; Fred T. Kitt, Seattle, Wash. App. filed March 6, 1920.

1,509,165. ILLUMINATED TOOL HOLDER; Albert A. Montero, Springfield, Miss. App. filed Oct. 9, 1923.

1,509,184. MULTIPLE-BAND WAVE FILTER; Otto J. Zobel, Maplewood, N. J. App. filed April 30, 1920.

1,509,185. FUSE; John P. Arndt, South Milwaukee, Wis. App. filed March 21, 1919. High-voltage type.

1,509,186. STORAGE CELL, ELECTRODE THEREFOR AND PROCESS OF MAKING THE SAME; Raymond C. Benner, Bayside, N. Y. and Harry F. French, Flushing, N. Y. App. filed Aug. 16, 1922.

1,509,207. HEATING SYSTEM; Walter E. Hudson, Amagansett, N. Y. App. filed June 7, 1921. Hot-water type, electrically operated.

1,509,209. DEFERRED-ACTION DRY BATTERY; Alton K. Huntley, Madison, Wis. App. filed May 4, 1921.

1,509,210. MEANS FOR CONTROLLING SOLENOID BRAKES; Brent C. Jacob, Cleveland, Ohio. App. filed Nov. 25, 1922. For overhead hoisting and conveying machines.

1,509,211. ELECTRIC LAMP; Joseph B. Kausal, Chicago, Ill. App. filed June 28, 1922. Lamp and casing with reflector.

1,509,228. AUTOMATIC CARRIAGE-REVERSING MECHANISM FOR TYPEWRITERS; Jose M. Carino, Washington, D. C. App. filed March 7, 1923.

1,509,235. THEFT DETECTOR FOR AUTOMOBILES; Joseph G. Giuliani, Washington, D. C. App. filed May 2, 1923.

1,509,248. SELF-SETTING TRANSMISSION SYSTEM; Elmer Meitner, Brooklyn, N. Y. App. filed April 10, 1918. Adapted to position an indicator in accordance with position of a remotely located element.

1,509,272. FUSE PLUG; Luigi Vecchio, Schenectady, N. Y. App. filed June 25, 1920. Renewable.

1,509,279. STRAIN INSULATOR; Arthur O. Austin, Barberton, Ohio. App. filed April 10, 1919. High-tension type.

1,509,288. OUTLET BOX; Syles R. Fralick, Chicago, Ill. App. filed Nov. 24, 1920.

1,509,290. SIGNAL AND DISPLAY LAMP; Ross F. George, Seattle, Wash. App. filed Feb. 14, 1922.

1,509,298. AUTOMATIC TELEPHONE SYSTEM; Emil Jacobsen, Port Washington, N. Y. App. filed Sept. 5, 1918.

1,509,308. RADIO TRANSMISSION SYSTEM; Mendel Osnos, Berlin, Germany. App. filed Aug. 8, 1922. Using a plurality of transmitters and a high-frequency machine with sectionalized windings.

1,509,321. COMBINED TROLLEY WIRE AND GUARD HANGER; Anthony Shacikoski, Homer City, Pa. App. filed May 6, 1924.

1,509,331. INDUCTION SYNCHRONOUS MOTOR; Tadaoki Yamamoto and Masataro Kawarada, Tokyo, Japan. App. filed July 16, 1921. Induction motor connected in cascade with a direct-current series generator.

1,509,354. PORTABLE ILLUMINATING DEVICE; Carl Hambuechen, New York, N. Y. App. filed Dec. 3, 1920. Flashlight.

1,509,384. WELDING; Valentine E. Walter, Brooklyn, N. Y. App. filed March 22, 1923. Method of welding together two pieces of different resistances.

1,509,396, 1,509,397. ELECTRIC REGULATION; John L. Creveling, White Plains, N. Y. Automatic regulation for dynamos as used on train-lighting systems.

1,509,434. TELEPHONE-EXCHANGE SYSTEM; Ottmar H. Kopp, Brooklyn, N. Y. App. filed April 28, 1921. Machine switching.

1,509,439. COMBINATION CONNECTOR PLUG AND AUTOMATIC SWITCH; William Morlok, Philadelphia, Pa. App. filed Dec. 4, 1922. For flatirons.

1,509,488. ELECTRIC HANDLAMP; Allen J. Rishel, Reading, Pa. App. filed Jan. 23, 1923.

1,509,493, 1,509,494. PROTECTIVE DEVICE; Joseph Slepian, Swissvale, Pa. App. filed Feb. 16, 1922. Disk-pile type of lightning arrester.

1,509,495, 1,509,496. PLATE AND METHOD OF TREATING THE SAME. Joseph Slepian, Swissvale, Pa. App. filed April 1, 1922. For use in lightning arrester.

1,509,497. SPARK-GAP STRUCTURE; Joseph Slepian, Swissvale, Pa. App. filed Oct. 2, 1922. For spark gaps which break down at 350 volts to 500 volts.

1,509,501. APPARATUS FOR EXCITING ALTERNATORS; André Blondel, Paris, France. App. filed Feb. 28, 1920. To limit short-circuit current.

1,509,514, 1,509,515. LIGHTNING ARRESTER; George M. Little, Pittsburgh, Pa. App. filed July 13, 1922. Disk-pile type.

1,509,516. TIME-CONTROLLED LIGHTING SYSTEM; Gustav Lussi, Philadelphia, Pa. App. filed May 18, 1923.

1,509,521, 1,509,522. CURRENT-COLLECTING DEVICE; Samuel S. Matthes, Mansfield, Ohio. App. filed Nov. 18, 1921. For trackless trolley.

1,509,534. ELECTROPLATING MACHINE; Guerin Todd, Millburn, N. J. App. filed June 26, 1923. In which articles to be electroplated are packed in a barrel or container which is then immersed and rotated in an electrolytic bath.

1,509,559. ELECTRIC LIGHTING FIXTURE; Valerius T. Jennings, Chicago, Ill. App. filed Feb. 5, 1924.

1,509,561. ELECTRIC HEATER; Earl W. Lothamer, Canton, Ohio. App. filed Sept. 7, 1922. Arranged with wall bracket for mounting.

1,509,583. STORAGE-BATTERY-SEALING DEVICE; Wendell H. Caldbeck, Des Moines, Iowa. App. filed Aug. 23, 1920.

1,509,609. HIGH-TENSION FUSE; Emil Pfiffner, Budapest, Hungary. App. filed May 13, 1924. Having a multiple spark-gap electrically connected with a fuse wire.

1,509,615. MULTIPLE-BLADE KNIFE SWITCH; Ira R. Seltzer, Waterbury, Conn. App. filed Aug. 26, 1921.

1,509,645. INSULATOR; Marvin J. Foss, Faribault, Minn. App. filed Feb. 2, 1922. That does not require a tie wire.

1,509,650. HERMETICALLY SEALED DRY CELL; George W. Heise, Elmhurst, N. Y. App. filed June 30, 1921.

1,509,661. IRONING MACHINE; Leo Potter, New York, N. Y., and Robert J. Mompere, Newark, N. J. App. filed Aug. 25, 1921.

1,509,665. CURRENT COLLECTOR; Cyrus B. Buchanan and Charles C. Johnson, Richmond, Va. App. filed Aug. 1, 1921. For trackless trolley.

1,509,666. ELECTRICAL APPARATUS; John G. Campbell, Dayton, Ohio. App. filed July 30, 1923. Brush rigging.

1,509,672. ATTACHMENT PLUG; Arthur C. Gaynor, Stratford, Conn. App. filed March 4, 1922. Separable.

1,509,691. MULTI-OFFICE TELEPHONE SYSTEM; Rodney G. Richardson, Chicago, Ill. App. filed July 19, 1920.

1,509,702. FUSE PLUG; Harold J. Berrian, Fisher's Island, N. Y. App. filed Feb. 9, 1923. Renewable.

1,509,717. REEL CARRIER; Charles C. Davis, Northfield, Vt. App. filed Nov. 27, 1923.

1,509,719. FOUNTAIN PEN AND ELECTRIC LIGHT; John J. Devine, Middletown, Conn. App. filed June 12, 1923. Combined.

1,509,736. APPARATUS FOR RECORDING THE TIMES AT WHICH A VEHICLE PASSES TWO GIVEN POINTS; Ernest E. Lucy, Sydney, New South Wales, Australia. App. filed Sept. 1, 1921.

1,509,737. WHEEL MOTOR FOR FOUR-WHEEL DRIVES; Harry C. McCleary, Washington, D. C. App. filed Sept. 27, 1923.

1,509,744. LAMP SHADE; Rose E. Wilson, Long Beach, Cal. App. filed April 7, 1923. Table-lamp type.

1,509,745. GLOBE HOLDER FOR ILLUMINATING FIXTURES; Frank Yokel, Avalon, Pa. App. filed June 21, 1923.

1,509,758. ELECTRIC SWITCH; Herman J. H. Huber, Schenectady, N. Y. App. filed Aug. 30, 1920. That prevents rebounding of the mechanism.

1,509,767. AUTOMOBILE INDICATOR; Charles A. O'Toole, Brooklyn, N. Y. App. filed June 23, 1921.

1,509,790. PROCESS FOR MAKING ELECTRODES; John M. Stephensen, Brooklyn, N. Y. App. filed April 1, 1922.

1,509,805. TELEPHONE RECEIVER; Harold P. Donle, Meriden, Conn. App. filed April 25, 1922.

1,509,813. ELECTRIC MOTOR; Joseph M. Rodriguez, Brooklyn, N. Y. App. filed Aug. 29, 1921. The stator of which may be removed and replaced without moving the motor from the position in which it may have been mounted.

1,509,817. TELEPHONICALLY OPERATED SOUND RECORDING AND REPRODUCING MACHINE; James W. Owen, Secane, Pa., and Albertis Hewitt, Camden, N. J. App. filed Aug. 25, 1916.

1,509,818. MICROPHONE; James W. Owen, Secane, Pa., and Albertis Hewitt, Camden, N. J. App. filed Aug. 25, 1919.

(Issued September 30, 1924)

1,509,822. SEPARABLE CONTACT; Reuben B. Benjamin, Chicago, Ill. App. filed April 26, 1919. Attachment plug.

1,509,830. DRIVING AND CONTROLLING MECHANISM FOR WASHING MACHINES; Oscar F. Fischedick and Alvin W. Krahn, Milwaukee, Wis. App. filed Dec. 26, 1919.

1,509,839. ELECTRICAL FIXTURE CONNECTION; Peter R. Kuhn, New York, N. Y. App. filed July 19, 1920.

1,509,851. SIGNALING SYSTEM; Edwin F. Trapp, Valley Stream, N. Y. App. filed Dec. 2, 1920. Adapted to apply varying potential to a subscriber's telephone line upon which the receiver has been inadvertently left off its switch hook.

1,509,884. ELECTRIC GENERATOR; Fred J. Terwilliger, Montague, Cal. App. filed July 11, 1923. Of the type used in connection with motor-driven vehicles.

1,509,886. PRINTING-TELEGRAPH SYSTEM; Gilbert S. Vernam, Brooklyn, N. Y. App. filed Sept. 5, 1923. That can be readily changed from full duplex to half duplex.

1,509,901. ELECTRICAL MEASURING SYSTEM; Harry Nyquist, Elmhurst, N. Y. App. filed Oct. 28, 1921. For determining the magnitude of flutter effect produced in a loaded signaling circuit adapted for the simultaneous transmission of telephone and telegraph currents.

1,509,926. MOTOR-CONTROL SYSTEM; Edgar M. Bouton, East Pittsburgh, Pa. App. filed Oct. 11, 1922. For elevators, hoists and similar machines.

1,509,941. ELECTRIC FURNACE BALANCING SYSTEM; Robert D. Evans, Wilkinsburg, Pa. App. filed May 13, 1918. For imposing an unbalanced polyphase load upon a balanced polyphase supply system without disturbing the balance of the system.

1,509,943. SAFETY CONTROLLER HANDLE; Clyde C. Farmer, Pittsburgh, Pa. App. filed Dec. 1, 1921. As used on electric cars.

1,509,947. METALLURGICAL PROCESS; William E. Greenawalt, Denver, Col. App. filed July 22, 1921. For the treatment of complex ores.

1,509,953. FAN; Charles W. Johnson, Pittsburgh, Pa. App. filed Dec. 30, 1918. Blades composed of fibrous material impregnated with a hardened binder.

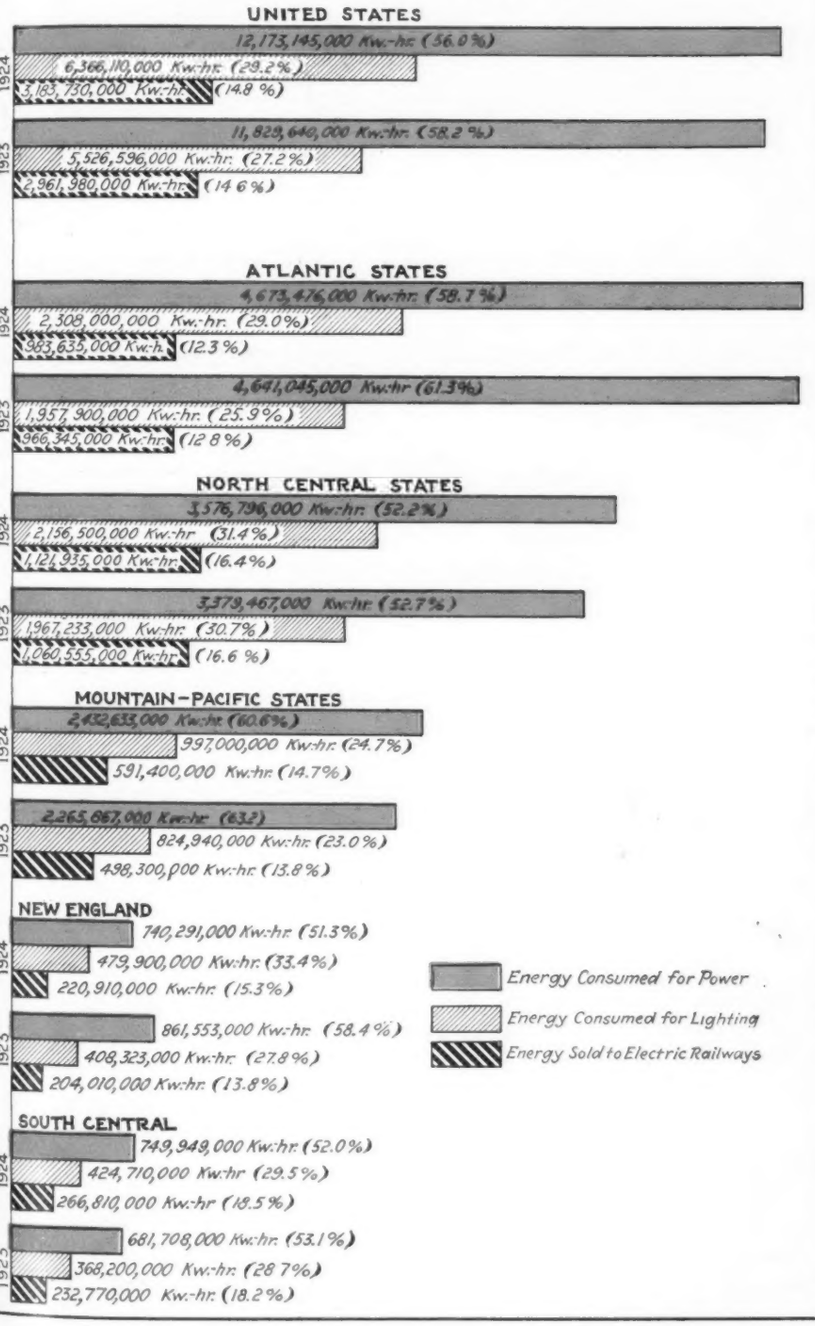
1,509,954. CONTROL APPARATUS; Howard H. Johnston, Edgewood Park, Pa. App. filed March 11, 1919. Interlocking type for electric car control.

1,509,959. TESTING DEVICE FOR DRY BATTERIES; David W. Landes, Portland, Ore. App. filed June 16, 1921

Business Facts for Electrical Men

Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business

Distribution of Central-Station Energy During First Six Months of 1923 and 1924



Most of the data for statistics in the ELECTRICAL WORLD are gathered by it from original sources. Privilege is freely given to readers of the ELECTRICAL WORLD to quote for use these statistics for any legitimate purpose. While there is no requirement that the source of data be given, yet it would help the ELECTRICAL WORLD in obtaining and compiling further basic information if those who make use of these statistics would give credit to the ELECTRICAL WORLD.

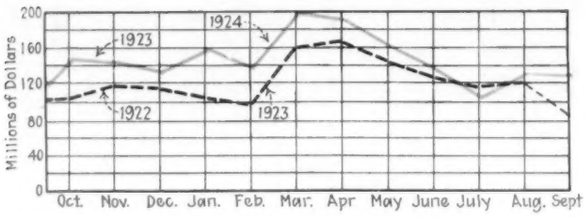
Distribution of Central-Station Energy

INDUSTRY in general has adopted electrical energy as a source of power to such a large extent that any study of the relative distribution of energy generated in central-station plants must take into consideration the economic conditions of the country. No set figures can be put down as to the proportion of electrical energy which is consumed for light, power and transportation, for industry, the greatest user of central-station energy, is seldom operating at normal, being either a few per cent above or below the point of normal activity as the business and industry cycle unfolds.

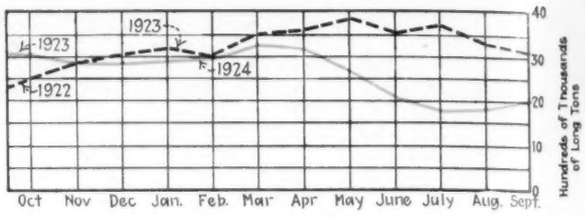
This is strikingly brought out in the accompanying diagram showing the consumption of central-station energy in the five divisions of the country during the first half of 1923 and 1924. In the country as a whole 58.2 per cent of the central-station energy was sold to industrial power customers during the first six months of last year, while only 56.0 per cent was used for power during the same period this year. This was due to two primary causes—first, the curtailment in general industrial activity which has been prevalent since the opening of the year, and, second, the taking on of almost two million new lighting customers during 1923. Neither lighting consumption nor the amount of energy used by electric railways is materially affected by general industrial conditions, and as a result the percentage of the total used by these types of customers was higher this year than last.

The industrial inactivity of this year appears to have affected distribution in New England to a greater extent than in any other section of the country. In every section of the country, however, the proportion of energy used for power this year was less than that of last year.

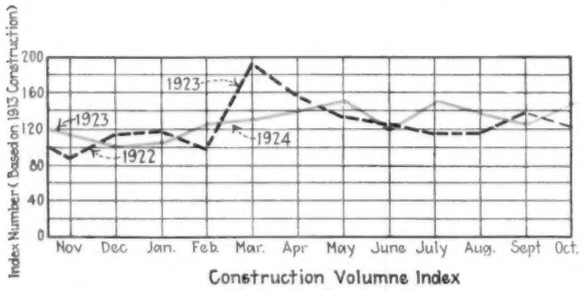
How the Primary Industries Are Trending



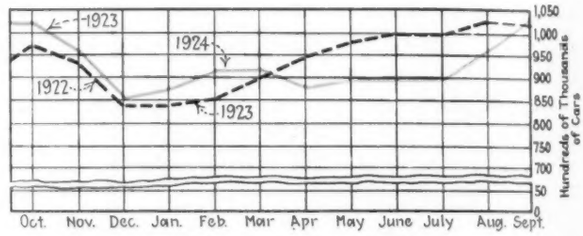
Contracts Awarded for Residential Buildings



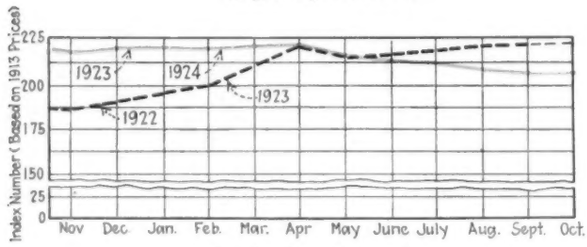
Pig-Iron Production



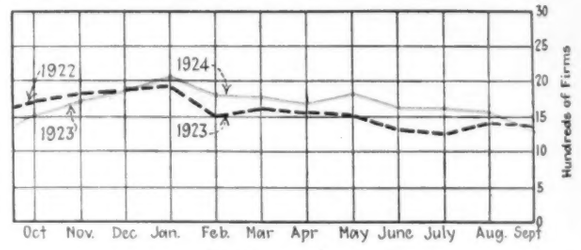
Construction Volumne Index
(Engineering-News Record)



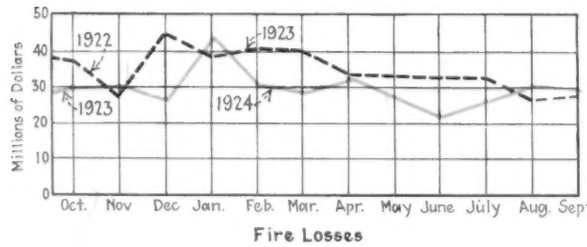
Total Average Weekly Freight-Car Loadings



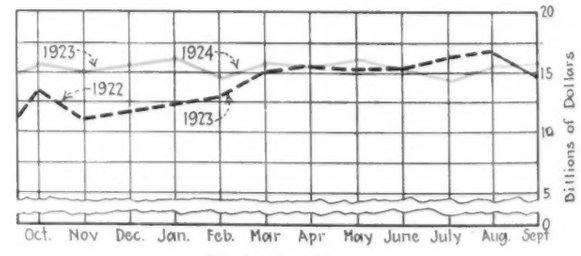
Construction Cost Index
(Engineering-News Record)



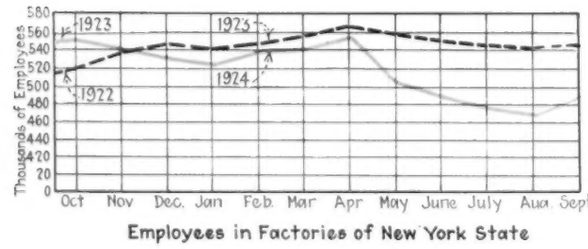
Business Failures



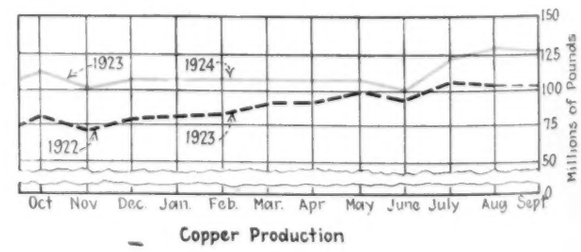
Fire Losses



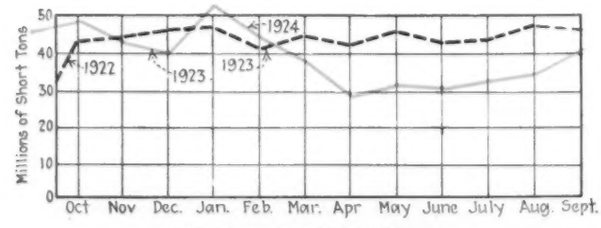
Bank Clearings
(Outside of New York City)



Employees in Factories of New York State



Copper Production



Bituminous Coal Production

Increased Business Activity During September

A NOTICEABLE improvement in general business activity was recorded during September. Freight-car loadings were increased to par with the highest of the year, and practically all of the primary industries reported increased activity. These favorable conditions were reflected in a decrease in number of unemployed.